Appeal No. 15-1891

UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

ICON HEALTH & FITNESS, INC., a Delaware corporation,

Plaintiff-Appellant,

v.

POLAR ELECTRO OY, a Finnish company, POLAR ELECTRO, INC., a Delaware corporation,

Defendants-Appellees.

APPEAL FROM THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF UTAH IN 1:11-CV-00167-BSJ, JUDGE BRUCE S. JENKINS

BRIEF OF APPELLANT ICON HEALTH & FITNESS, INC.

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CERTIFICATE OF INTEREST

Counsel for the appellant Icon Health & Fitness, Inc. certifies the following:

1. The full name of every party or amicus represented by me is:

   Icon Health & Fitness, Inc.

2. The name of the real party in interest represented by me is:

   Icon Health & Fitness, Inc.

3. All parent corporations and any publicly held companies that own 10 percent or more of the stock of the party or amicus curiae represented by me are:

   HF Holdings, Inc. is the parent company.

4. The names of all law firms and the partners or associates that appeared for the party or amicus now represented by me in the trial court or agency or are expected to appear in this court are:

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DATED: OCTOBER 2, 2015

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STATEMENT OF RELATED CASES

There are no pending appeals related to the present appeal. There is one other district court matter involving the patent at issue here, styled *Icon Health & Fitness, Inc. v. Garmin Int'l and Garmin USA*, Case No. 1:11-CV-00166-RJS (D. Utah). The *Garmin* court issued an order on September 29, 2015 granting the defendants' motion for judgment on the pleadings based in part on issue preclusion arising from entry of the judgment appealed herein.

JURISDICTIONAL STATEMENT

This is an appeal from a judgment entered by the United States District Court for the District of Utah (Case No. 1:11-CV-00167-BSJ) and certified final pursuant to Rule 54(b), Fed. R. Civ. P. Jurisdiction therefore arises under 28 U.S.C. § 1295(a)(1). *See Keurig, Inc. v. Sturm Foods, Inc.*, 732 F.3d 1370, 1372 (Fed. Cir. 2013) (noting appellate jurisdiction arises under 28 U.S.C. § 1295(a)(1) where district court certified judgment pursuant to Fed. R. Civ. P. 54(b)).

The claim nominally disposed of by the Rule 54(b) judgment was plaintiff-appellant Icon Health & Fitness, Inc.'s ("Icon") claim for infringement of United States Patent No. 6,921,351 ("the '351 patent"). (A1,

Judgment in a Civil Case ("Rule 54(b) Judgment").) The memorandum opinion and order behind that judgment, however, did not address the issue of infringement but rather found the claims of the '351 patent indefinite, and therefore invalid. (A2-A24, Memorandum Opinion & Order Regarding Claim Construction ("Opinion").) Consequently, the sole issue on appeal is indefiniteness. This is because the scope of appellate jurisdiction includes all orders leading up to and issues underlying the judgment. *See Thompson v. Haynes*, 305 F.3d 1369, 1383-1384 (Fed. Cir. 2002) (inventorship accepted as issue on appeal despite not being mentioned in Rule 54(b) judgment, because it was addressed in district court's findings of fact and conclusions of law, which provided basis for Rule 54(b) judgment); *In re Gabapentin Patent Litig.*, 503 F.3d 1254, 1264 (Fed. Cir. 2007) ("the court's entry of final judgment on the issue of noninfringement was not limited to two particular motions … but rather encompassed the court's claim construction rulings that pertained to the issue of noninfringement"); *see also Doctor's Hosp. of Jefferson, Inc. v. Southeast Medical Alliance, Inc.*, 123 F.3d 301, 307 n. 10 (5th Cir. 1997) ("a notice of appeal identifying the district court's order dismissing [certain identified] claims properly confers jurisdiction on this court over all interlocutory

orders on the way to that partial final judgment"). In the present case, the basis for entry of judgment in favor of defendants-appellees Polar Electro Oy and Polar Electro Inc. (collectively, "Polar") on Icon's infringement claim was in fact not a determination that the accused products fell outside the scope of the asserted claims, properly construed. (*See* A2-A24, Opinion; A25-A27, Order Granting Icon Health & Fitness, Inc.'s Unopposed Motion to Direct Entry of Judgment on Its Third Claim for Relief ("Rule 54(b) Order").) Rather, the district court determined it was unable to construe the asserted claims and therefore found them invalid as indefinite under pre-AIA 35 U.S.C. § 112, ¶ 2.[1] (A24, Opinion at 23.) It was on the basis of this indefiniteness ruling that the district court directed entry of judgment against Icon on its infringement claim. (A24, Opinion at 23; A25-A27, Rule 54(b) Order at 1-3.) The substantive scope of jurisdiction on appeal is thus

[1] The application that resulted in the '351 patent was filed on October 19, 2001 (A28, '351 patent, face page), many years before September 16, 2012, the date on which § 4(c) of the Leahy–Smith America Invents Act ("AIA"), Pub. L. No. 112–29, took effect, replacing former § 112, ¶ 2 with newly designated § 112(b). Consequently, the discussion herein will refer the pre-AIA version of the statute. *See Biosig Instruments, Inc. v. Nautilus, Inc. (Nautilus III)*, 783 F.3d 1374, 1377 n. 1 (Fed. Cir. 2015) (noting propriety of applying pre-AIA statute where application for patent-in-suit filed before effective date of AIA).

whether the claims are definite, as required by pre-AIA 35 U.S.C. § 112, ¶ 2. If Icon prevails here, the finding of indefiniteness should be reversed and the judgment of noninfringement vacated.

STATEMENT OF THE ISSUES

Whether the district court erred in concluding that the claims, when read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention. (*See* A24, Opinion at 23.)

STATEMENT OF THE CASE

This is an appeal from a determination by the district court that the claims of the '351 patent are invalid as indefinite under pre-AIA 35 U.S.C. § 112, ¶ 2.[2] Specifically, the district court found the claim terms "in-band," "out-of-band," and "relationship" to be "ambiguous and incapable of construction," and concluded the claims containing these terms "fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." (A24, Opinion at 23.)

[2] See footnote 1.

I. The Claims

The allegedly ambiguous terms are found in independent claims 1 and 5, which are reproduced below, with the terms at issue shown in bold:[3]

1. An exercise system comprising:

a local system including at least one exercise apparatus and at least one associated local server, said at least one local server monitoring the operation of said at least one exercise apparatus, said exercise apparatus and said local server having an **in-band** communication using a bid-directional[4] wireless protocol;

an **out-of-band** communication with a user of said at least one exercise apparatus, wherein said **out-of-band** communication has a **relationship** to said **in-band** communication;

a remote server; and

wherein said local server and said remote server include communication interfaces which permits communication over a packet network connection that at least part-time couples said local server to said remote server for data communication between said local server and said remote server, such that said remote system may receive local system data from said local server concerning said operation of said exercise apparatus, and such that said local system may receive remote server data from said remote server providing feedback concerning said operation of said exercise apparatus.

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[3] The allegedly ambiguous terms are also present in the claims depending from claim 1 (claims 2-4) and claim 5 (claims 6-10) and in dependent claim 13.

[4] The parties agree that the word "bid-directional" is a typographical error, and should be read as "bi-directional." (A12, Opinion at 11, n. 2.)

(A75, '351 patent, claim 1.)

5. An exercise system comprising:

at least one exercise apparatus having an **in-band** bi-directional wireless communication device;

an **out-of-band** communication device capable of a communication with a user of said at least one exercise apparatus that has a **relationship** to said **in-band** communication;

at least one associated local server having a bi-directional wireless communication device such that said exercise apparatus and said local server may communicate with each other via a wireless connection; and

at least one remote server in communication with said local server via, at least in part, an Internet connection, said remote server at least temporarily storing information concerning exercise sessions performed on said exercise apparatus.

(A76, '351 patent, claim 5.)

II. The Specification

The application for the '351 patent, entitled "Method and Apparatus for Remote Interactive Exercise and Health Equipment," was filed on October 19, 2001 and issued on July 26, 2005. (A28, '351 patent, face page.) The '351 patent "relates generally to health and exercise equipment, and more particularly to computer networked systems including health or exercise equipment." (A61, '351 patent, col. 1, lines 8-10.) The patent thus describes an exercise system made up of a local system (which includes one

or more exercise devices, each associated with its own or a common local computer) and a remote system (which includes at least one remote computer) that are coupled together (via a computer network, such as the Internet or other wide area network) to exchange data concerning user activity. (A28, '351 patent, Abstract.)

The problem the '351 patent set out to address in 2001, generally stated, is the age-old quandary of motivating oneself to stick to an exercise regimen. (A61-A62, '351 patent, col. 1, line 12—col. 2, line 47; col. 3, lines 14-35.) A foundational premise of the patent is thus that "[g]ood health is a fundamental requirement for a happy and long life." (A61, '351 patent, col. 1, lines 12-13.) By 2001, when the application for the patent was drafted, a booming fitness industry had arisen to service the pursuit of good health, including both commercial fitness centers and home health and fitness equipment. (*Id.*, col. 1, lines 13-43.) Maintaining a commitment to exercise nonetheless remained a challenge for many. Impediments encountered by patrons (and would-be patrons) of commercial fitness centers included the high cost associated with membership and the inconvenience of having to make a special trip to the gym. (A61, '351 patent, col. 1, lines 23–29.) Home fitness equipment in 2001 presented an alternative, in that it was likely less

expensive than a gym membership, and also solved the inconvenience problem, but it could not offer the type of camaraderie typically found in a group exercise setting. (*Id.*, col. 1, lines 33-52.) As a result, the home fitness equipment of the day did not offer much in terms of helping users maintain their commitment to an exercise regimen. (*Id.*) Personal trainer services were one means used by some to foster commitment, but such services were expensive and, consequently, not frequently used. (*Id.*, col. 1, lines 53-65.) And even within the commercial gym setting, patrons suffered a lack of motivation to consistently use the available exercise machines because they (the machines, and consequently the patrons) were often isolated from one another and thus incapable of providing the incentive of a group experience. (*Id.*, col. 1, line 66—col. 2, line 18.)

The inventors of the '351 patent thus recognized in 2001 that exercise in a group setting and the motivation provided by a personal trainer are important components of remaining engaged in one's commitment to exercise, so they came up with a system that includes computerized exercise devices networked together to provide a group setting, if desired, and also capable of providing feedback and encouragement to the user (to simulate the function of a personal trainer) based on the user-generated

data collected locally. (*Id.*, col. 2, lines 22-28.) The inventive system further includes a remote system that communicates with the local system, via the Internet for example, which allows real-time feedback from a virtual personal trainer, or an actual human personal trainer, to coach and encourage the individual local user, or a group of networked local users. (*Id.*, col. 2, lines 28-55; A62, '351 patent, col. 3, lines 4-13.) Significantly, the system can be used with any exercise equipment having a computer, whether it is an indoor rowing machine (for example), or an outdoor bicycle (also an example) outfitted with a compact processor for tracking speed, RPM, cadence, and the like. (*E.g.*, A63, '351 patent, col. 5, lines 37-53; A69, '351 patent. col. 17, lines 19-46.)

Implicit in the '351 patent is the idea that some communications, at least in 2001, were simple and required only the most basic hardware (low-bandwidth communications, for example), while other communications, such as stereo audio and video, were very complex and required considerably more complex, and thus more expensive, hardware. (*E.g.*, A69, '351 patent, col. 18, lines 45-54.) The patent speaks in terms of providing inexpensive exercise devices so that they may become "ubiquitous" and thus readily accessible to all. (*E.g.*, A62, '351 patent, col.

3, lines 36-37.) It therefore distinguishes between what it regards as baseline communication technology, which it labels "in-band," and enhanced communication technology, which it labels "out-of-band." (*E.g.*, A72, '351 patent, col. 23, line 59—col. 24, line 7.) "In-band" communications are described as simple communications that may be handled by "an inexpensive base controller for minimal 'in-band' communications." (A62, '351 patent, col. 3, lines 38-39.) The inventors contemplated that every device would have at least "in-band" capabilities. (*Id.*, col. 3, lines 38-41; A68, '351 patent, col. 16, line 65—col. 17, line 4.) "Out-of-band" communications, on the other hand, require such massive processing power that they may only be handled by additional, more complex, and more expensive, add-on hardware. (A69, '351 patent, col. 18, lines 51-54; A72, '351 patent, col. 23, line 59—col. 24, line 7.)

Thus the distinction between "in-band" and "out-of-band" communications is that the former uses rudimentary hardware but the latter requires separate, more advanced hardware. The corollary to this is that "in-band" communications travel one pathway (to the rudimentary hardware), while "out-of-band" communications travel a different pathway (to the add-on hardware). The claims require that the "in-band"

and "out-of-band" communications have a "relationship" to one another. The specification makes clear that the two are mutually exclusive and relate to one another in that both communicate data from the same exercise session. (*E.g.*, A68, '351 patent, col. 16, lines 50-63; A75, '351 patent, claim 1.)

The patent also explains that if a single piece of sufficiently powerful hardware were provided, then all communications might travel a single pathway (such as the 802.11 wireless protocol) and be handled by that single piece of hardware. (A68, '351 patent, col. 16, line 64—col. 17, line 18; A72, '351 patent, col. 24, lines 15-22.) In this scenario, all communications can be described as "in-band," because all travel a common pathway and are handled by the single, enhanced hardware component. (*Id.*) The claims do not purport to read on such embodiments, which involve no "out-of-band" communications.

III. The Prosecution History

The claims were amended once during prosecution of the application for the '351 patent. The examiner initially rejected the originally-presented claims as anticipated by the prior art. (A613-A616, Office Action mailed June 15, 2004.) In response, the inventors amended the claims to call out the

"in-band"/"out-of-band" dichotomy. (A618-A626, Amendment and Remarks received Oct. 12, 2004.) The amended claims are shown below, with the added text shown in underlined font and the deleted text shown in strikethrough font:[5]

1. An exercise system comprising:

a local system including at least one exercise apparatus and at least one associated local server, said at least one local server monitoring the operation of said at least one exercise apparatus, said exercise apparatus and said local server having an in-band communication using ~~communicating with~~ a bi-directional wireless protocol;

an out-of-band communication with a user of said at least one exercise apparatus, wherein said out-of-band communication has a relationship to said in-band communication;

a remote server; and

wherein said local server and said remote server include communication interfaces which permits communication over a packet network connection that at least part-time couples said local server to said remote server for data communication between said local server and said remote server, such that

[5] Claim 11 was also amended, but in ways not relevant to the present proceedings. Claim 13, which depends from claim 11 was amended to change "and said controller is wireless" to "and said controller is an in-band communication, and further comprising communicating with an out-of-band communication with a user of said exercise device." (A621-A622.) This change obviously involves the claim terms at issue, but does not bring anything new to the discussion, so it plays no role in the analysis presented herein.

said remote system may receive local system data from said local server concerning said operation of said exercise apparatus, and such that said local system may receive remote server data from said remote server providing feedback concerning said operation of said exercise apparatus.

(A619.)

5. An exercise system comprising:

at least one exercise apparatus having ~~a~~ an in-band bi-directional wireless communication device;

an out-of-band communication device capable of a communication with a user of said at least one exercise apparatus that has a relationship to said in-band communication;

at least one associated local server having a bi-directional wireless communication device such that said exercise apparatus and said local server may communicate with each other via a wireless connection; and

at least one remote server in communication with said local server via, at least in part, an Internet connection, said remote server at least temporarily storing information concerning exercise sessions performed on said exercise apparatus.

(A620.)

In the remarks accompanying the amendments, the examiner's attention was specifically directed to the introduction of the "in-band" and "out-of-band" concepts, and their "relationship," as points of distinction over the alleged prior art:

> One of the aspects of an embodiment of Applicant is the use of in-band communication *in conjunction with* out-of-band communication in an exercise system. See, for example, Applicant's Fig. 13 and accompanying description on page 28, lines 19-29. Watterson '060 does not hint of such a combination. … Applicant therefore respectfully requests that the rejections based upon Watterson '060 be withdrawn.

(A625 (emphasis added).)

The examiner must have understood the "in-band," "out-of-band," and "relationship" concepts presented by the amendments, and understood their efficacy in distinguishing the amended claims over the alleged prior art, because his next action in examining the application was to issue a Notice of Allowance. (A628-A631, Notice of Allowance mailed March 14, 2005, "responsive to 10/12/04" (*see* A631).) The '351 patent subsequently issued on July 26, 2005. (A28, '351 patent, face page.)

IV. The Proceedings before the District Court

From May 30, 2013, through January 10, 2014, the parties engaged in claim construction briefing and argument. (*See* A86-A88, PACER Docket at Nos. 52, 53, 55, 56, 57, 58, 64, 69, 72.) Notably, long before adopting its indefiniteness argument, Polar proposed constructions for terms and phrases that included one or more of "in-band," "out-of-band" and "relationship." (A139-A147, Joint Claim Construction and Prehearing

Statement (proposed constructions at Exs. A and B).) Polar retreated from its proposed constructions during the middle of the scheduled briefing period, so the district court allowed supplemental briefing to address Polar's new indefiniteness arguments. (A293, Minute Entry re 12/6/13 Hearing.)

Following a claim construction hearing on January 10, 2014, the district court took the matter under advisement. (A324, Minute Entry re 1/10/14 Hearing.)

On August 21, 2014, following and in light of the United States Supreme Court's decision in *Nautilus, Inc. v. Biosig Instruments, Inc. (Nautilus II)*, 134 S.Ct. 2120 (2014), the district court held a supplemental hearing at which supplemental briefing was ordered. (A507, Minute Entry re 8/21/14 Hearing; *see also* A88-A89, PACER Docket at Nos. 74, 76, 77, 78.)

On October 3, 2014, the district court issued a "Notice Regarding Claim Construction" in which it directed the parties to retain experts, complete expert discovery, and report back to the court for an evidentiary hearing. (A750, Notice Regarding Claim Construction.) At the district court's subsequent direction, the parties filed additional supplemental briefs regarding the testimony of their respective experts, and also filed the

declarations prepared by their respective experts. (A751, Minute Entry re 1/7/15 Hearing; A90, PACER Docket at Nos. 85, 86, 87, 88.)

On February 27, 2015, the district court conducted an evidentiary hearing for the purpose of having each expert proffer the testimony he would present at trial. (A2081, 2/27/15 Hrg. Tr. at 4:17-19 ("THE COURT: Okay. We calendared the matter as an evidentiary hearing. Pretend like you're in trial. The proffer consists of the testimony of your expert."); *see also* A1464, Minute Entry re 2/27/15 Hearing.)

On March 30, 2015, the district court convened a hearing on Polar's motion for summary judgment, which Polar had filed on the limited basis of the alleged indefiniteness of the term "relationship." (*See* A90-A91, PACER Docket at Nos. 84, 98, 99, 100.) At the conclusion of the March 30, 2015 hearing the court offered the following remarks:

> The summary judgment motion as filed was of a somewhat limited nature having to do with, essentially, construing relationships [sic] in an effort to construe claims.
>
> The Court, finding that particular adventure somewhat daunting, requiring help, as a matter of process, we had you bring in your contending experts to provide a substantive footing to assist the Court in trying to adequately construe the claims.

I found the testimony by the experts quite helpful. Each purported to proffer the same testimony that he would offer at trial.

And the question really became, well, somewhat broader than the rather limited motion for summary judgment. And it had to do with the broader subject of whether the claims as filed were genuinely capable of construction with all do [sic] deference to Icon and with due deference to the patent office and the presumption of validity.

The argument today is broader than the limited argument for summary judgment. At least it has been so construed by the Court: Is the claim capable of construction, and if so, how do we construe it.

In light of the evidentiary footing that we have and in light of the broadened discussion that we've engaged in today, I think that, in light of the whole record and the whole claim, that the claim is incapable of a rational construction. It's plagued with the impermissible vagueness because of, among other things, the absence of a defined "band" in quotation marks or a defined referent as to whom messages are to be received or messages communicated from.

It lacks the clarity, in my opinion, and the specificity that would justify the issuance of a patent being incapable of rational construction. It seems to me that inherent in that is the question of validity. If you can't construe it, it can't be valid.

And the deficiency of impermissible vagueness and the absence of clarity and specificity and the absence of referent to whom the figures or the symbols refer justify I think the determination at this point that the patent's invalid for vagueness and the other reasons stated.

> We've been going fairly long this afternoon. And I'm going to ask counsel for the defendant to prepare and submit a suggested form of order with specific references to the record but retaining the right, quite obviously, to change or add to or exercise authorship in the event that it seems appropriate under the circumstances.
>
> And while I've referred to some things today, I'm tired and I'm sure there are other things so that I reserve the right to add or indeed subtract.
>
> I think it's a very interesting question and particularly in light of the recent pronouncements by the United States Supreme Court as to the propriety of dealing with an evidentiary base, a factual footing for arriving at a particular conclusion.

(A2048-A2050, 3/30/15 Hrg. Tr. Excerpt at 3:4-5:7.)

Shortly thereafter, as directed by the district court, Polar filed a "Proposed Memorandum Opinion and Order Regarding Claim Construction." (A2052-A2076.) The district court adopted Polar's proposal essentially verbatim,[6] including Polar's mistaken reference to the fictitious claim term "out-of-band device"; the claims of the '351 patent include no

[6] The only differences between the two are (1) the first page of the Opinion omits the introductory paragraph Polar included on its first page (*compare* A2 *with* A2052); (2) the second page of the Opinion adds a footnote in which the district court explains the Opinion supplants its oral order at the March 30, 2015 hearing (*compare* A3 *with* A2054); and (3) the last page of Polar's proposal has no "Conclusion" section, whereas the Opinion includes a "Conclusion" section prepared by the district court (*compare* A24 *with* A2074).

such term. (A2-A24, Opinion (mistaken references to "out-of-band device" at A2 and A3; compare same mistaken references at A2052 and A2053 of Polar's proposed order); A75-A76, '351 patent, claims 1-20.)

V. The Expert Testimony

The parties filed declarations from their respective experts. For Icon, Dr. Mohammed N. Islam articulated in his declaration (A943-A1006),[7] based on his own personal knowledge and his review of several specifically identified patents and textbooks contemporaneous to 2001, that:

> Although the specific definition of "in-band" and "out-of-band" may depend on the particular circumstance, in all of these examples *"in-band" refers to one pathway, and "out-of-band" refers to a different pathway. Therefore, the terms "in-band" and "out-of-band" were commonly used terms at the time of the invention, and one of ordinary skill in the art understood the difference between the two terms.*

(A964, Islam Decl., Ex. A, p. 18 (emphasis added); *see also* A964-A973 (examining contemporaneous 2001 patents and textbooks).) Dr. Islam also testified that "the phrase 'has a relationship' as used in claims 1 and 5 of

[7] Dr. Islam's December 8, 2014 expert report is attached as Exhibit A to the "Declaration of Mohammed N. Islam in Support of Icon Health & Fitness, Inc.'s Supplemental Claim Construction Brief Regarding Expert Testimony" ("Islam Decl."), filed February 13, 2015. (A944, ¶ 5.)

the '351 Patent would be understood by one of ordinary skill in the art, by its plain, ordinary, and common-use meaning." (A944.)

For Polar, Dr. Stephen Heppe stated in his declaration (A862-A925),[8] based on his review of a single contemporary technical dictionary defining "in-band signaling" and "out-of-band signaling," that:

> These definitions are clearly consistent with the tutorial provided earlier, and support the view that one of ordinary skill in the art would treat "in-band" and "out-of-band" as relative terms, only meaningful in relation to an explicit or implicit reference. "Signaling" and "communication" are general terms, which can be applied in many contexts (as the examples above demonstrate). Because of the broad and general use of these terms, they do not by themselves provide any particular context to understand "in-band" versus "out-of-band", or what an "in-band communication" might be, as opposed to an "out-of-band communication", *beyond the fact that they should be distinct in the context of a given reference*.

(A883, Heppe Decl., ¶ 53 (emphasis added); *see also* A882-A883, Heppe Decl., ¶¶ 51-52.) Dr. Heppe admitted in his declaration that "the terms 'in-band' or 'out-of-band', alone or as modifiers of 'communication', appear relatively straightforward (and historically, were indeed straightforward)…." (*Id.*, ¶ 19.) Dr. Heppe then proceeded to provide

[8] Dr. Heppe's December 8, 2014 "Declaration of Dr. Stephen Heppe" ("Heppe Decl.") was filed February 13, 2015.

another thirty paragraphs of "tutorial" ostensibly to "provide some background information on how one of ordinary skill in the art would interpret these terms, circa 2001, without regard to the patent at issue in this case or other intrinsic evidence." (*Id.*; *see also* A867-A882, Heppe Decl., ¶¶ 20-49.) The single reference Dr. Heppe cited as support for his testimony on this topic was a technical dictionary from the Institute of Electrical and Electronics Engineers, defining "in-band signaling" and "out-of-band signaling." (A882-A883, Heppe Decl., ¶¶ 50-52.) For the remainder of his declaration (excepting a few paragraphs attacking Icon's arguments), Dr. Heppe engaged in legal analysis, testifying about the meanings one of skill in the art would attribute to the terms at issue in light of their use in the claims, the specification, and the prosecution history. (A883-A908, A913-A916, Heppe Decl., ¶¶ 54-105, 118.)

At the February 27, 2015 evidentiary hearing (A2078-A2185), the experts testified essentially in accordance with their declarations. The district court, during Dr. Heppe's testimony, interjected, "I would be interested in his opinion as to the construction of Claim 1 and Claim 5." (A2160, 2/27/15 Hrg. Tr. at 83:18-19.) Dr. Heppe then proceeded, for the next twenty pages of the transcript, to testify as to his opinion of what the

claim terms mean in the context of the '351 patent, that is, when read in light of the claims, the remainder of the specification, and the prosecution history. (A2160-A2179; 2/27/15 Hrg. Tr., pp. 83-102.) At one point, Dr. Heppe stated:

> So my fundamental opinion is that since in-band and out-of-band are relative terms and require reference to give them meaning, one of ordinary skill cannot learn what they mean in the context of the claims because there is no reference provided in the '351 in its specification.

(A2166, 2/27/15 Hrg. Tr. at 89:21-25.)

VI. The Opinion

The Opinion issued by the district court (but actually authored by Polar) does not set forth an explicit "Findings of Fact" section. The Opinion states the district court was persuaded that "in-band," "out-of-band," and their "relationship" are unclear unless "in-band" is pre-defined. (A21, A24, Opinion at 20, 23.) Taken at face value, the Opinion appears to cite liberally to Dr. Heppe's expert declaration and his hearing testimony, apparently to suggest the cited propositions are fact-reliant. However, on close scrutiny, the great majority of the cited testimony is drawn from Dr. Heppe's legal analysis of the meaning of the claim language in light of the claims, the written description, and the prosecution history (i.e., the Opinion cites

primarily to ¶¶ 54-105 and 118 of the Heppe Decl. (A883-A908, A913-A916) and pages 83-102 of the 2/27/15 Hrg. Tr. (A2160-A2179)).

VII. The Undisputed Facts

At the evidentiary hearing, Dr. Heppe testified repeatedly that he and Icon's expert, Dr. Islam, are in agreement that people generally understand the terms "in-band" and "out-of-band" and that they are understood as being separate and distinct from one another:

> So the point of this discussion is that people do have an understanding of what in-band and out-of-band mean in the general sense, as Dr. Islam [Icon's expert] said. Dr. Islam also made very clear that people treat in-band and out-of-band as distinct and separate, and I fully agree with that.

(A2152, 2/27/15 Hrg. Tr. at 75:12-16.)

> Now, so Dr. Islam made the point that people understand in-band and out-of-band are distinct from one another. And as I said, I fully agree with that -- with that statement. They are distinct.

(A2155, 2/27/15 Hrg. Tr. at 78:16-19.)

> … in-band and out-of-band should be distinct. Dr. Islam agrees, he testified to that multiple times today.

(A2159, 2/27/15 Hrg. Tr. at 82:5-7.)

The experts differ only on the factual question of whether a person of ordinary skill in the art would need to be *provided* with a specific "in-band"

starting point (as distinguished from *selecting* one) in order to understand what is "out-of-band."

SUMMARY OF THE ARGUMENT

The district court received extrinsic evidence in the form of expert testimony. Icon's primary position is that intrinsic record is clear and that, as a result, the extrinsic evidence plays no role on appeal. De novo review in that case confirms those of ordinary skill in the art would understand the scope of the invention with reasonable certainty.

Alternatively, even if the extrinsic evidence is considered, de novo review remains the standard because of the way that evidence was used. Much of the expert testimony consists of legal analysis regarding the meaning of the claim language in light of the specification and prosecution history. The district court did not rely on the expert testimony to resolve underlying issues of fact, but relied instead on the expert's improper legal analysis. There are consequently no findings of fact to review for clear error, and de novo review remains the standard.

Further in the alternative, even if the district court is regarded as having resolved fact issues in deciding to adopt the reading of the disputed claim terms advocated by Polar's expert, the standard of review remains de

novo. The question of whether the meaning decided as a factual matter is one that makes sense as a matter of claim construction is a legal issue reviewed de novo. The district court erred as a matter of law in finding Polar's expert's view was one that comported with the rest of the patent.

Finally, and yet further in the alternative, if the district court's findings are determined to be findings of fact that must be reviewed for clear error, Icon argues the district court clearly erred. The testimony of Polar's expert is conclusory and unsupported, and defies all logic and common sense. There is no justification for the district court selecting such an overtly obtuse reading of the terms at issue, and the district court clearly erred in doing so.

ARGUMENT

I. Standard of Review

The district court's indefiniteness determination is reviewed de novo. *Biosig Instr., Inc. v. Nautilus, Inc. (Nautilus III)*, 783 F.3d 1374, 1377 (Fed. Cir. 2015). "Any fact critical to a holding on indefiniteness … must be proven by the challenger by clear and convincing evidence." *Intel Corp. v. VIA Techs.*, 319 F.3d 1357, 1366 (Fed. Cir. 2003); *see also Microsoft Corp. v. i4i Ltd. P'ship*, 131 S. Ct. 2238, 2242 (2011) (confirming that clear and convincing

evidence is required to overcome the presumption of validity conferred on all issued patents by 35 U.S.C. § 282). "In the face of an allegation of indefiniteness, general principles of claim construction apply." *Nautilus III*, 783 F.3d at 1377-1378 (citation and quotation marks omitted). "Though the ultimate construction of a claim term is a legal question reviewed de novo, underlying factual determinations made by the district court based on extrinsic evidence are reviewed for clear error." *Id.* at 1378 (*citing Teva Pharm. USA, Inc. v. Sandoz, Inc. (Teva II)*, 135 S. Ct. 831, 842 (2015)). However, "when the district court reviews only evidence intrinsic to the patent (the patent claims and specifications, along with the patent's prosecution history), the judge's determination will amount solely to a determination of law, and the Court of Appeals will review that construction de novo." *Teva II*, 135 S. Ct. at 841. In addition, when "the meaning of the claim at issue is clear in view of the intrinsic record and undisputed facts, we also review de novo." *Eidos Display, LLC v. AU Optronics Corp.*, 779 F.3d 1360, 1364-1365 (Fed. Cir. 2015) (*citing Teva II*, 135 S. Ct. at 840-842).

II. The claims of the '351 patent, viewed in light of the specification and prosecution history, inform those skilled in the art about the scope of the invention with reasonable certainty.

The definiteness requirement applicable to the '351 patent[9] is found in the second paragraph of 35 U.S.C. § 112, which reads:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

In *Nautilus II*, the Supreme Court stated the test for whether a claim meets the requirements of § 112, ¶ 2 as follows:

> … we read § 112, ¶ 2 to require that a patent's claims, viewed in light of the specification and prosecution history, inform those skilled in the art about the scope of the invention with reasonable certainty.

Nautilus II, 134 S.Ct. at 2129. This formulation of the standard is intended to balance the competing concerns of "the inherent limitations of language" and "appris[ing] the public of what is still open to them." *Id.* at 2128-2129 (citations and quotation marks omitted; brackets from *Nautilus II*). Thus, "[t]he definiteness requirement, so understood, mandates clarity, while recognizing that absolute precision is unattainable." *Id.* at 2129. Indeed, "the certainty which the law requires in patents *is not greater than is*

[9] See footnote 1.

reasonable, having regard to their subject-matter." *Nautilus III*, 783 F.3d at 1378-1379 (*quoting Nautilus II* and *Minerals Separation, Ltd. v. Hyde,* 242 U.S. 261, 270, 37 S. Ct. 82, 61 L. Ed. 286 (1916)) (emphasis added by *Nautilus III* court).

The terms at issue are "in-band," "out-of-band" and "relationship." (A24, Opinion at 23.) The question of indefiniteness, however, is not whether these terms are definite in and of themselves; the question is whether the claims employing these terms "inform those skilled in the art about the scope of the invention with reasonable certainty." *Nautilus II*, 134 S.Ct. at 2129. To answer that question, the court looks to "those sources available to the public that show what a person of skill in the art would have understood disputed claim language to mean [including] … the words of the claims themselves, the remainder of the specification, the prosecution history, and extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1314 (Fed. Cir. 2005) (en banc) (citations and quotation marks omitted).

"Of course, claims are not indefinite merely because they present a difficult task of claim construction." *Halliburton Energy Services, Inc. v. M-I*

LLC, 514 F.3d 1244, 1249 (Fed. Cir. 2008). "Only after a thorough attempt to understand the meaning of a claim has failed to resolve material ambiguities can one conclude that the claim is invalid for indefiniteness" *All Dental Prodx, LLC v. Advantage Dental Products, Inc.*, 309 F.3d 774, 780 (Fed. Cir. 2002).

A. The claims are clear that "in-band" refers to one pathway and that "out-of-band" refers to a separate and distinct pathway.

There is nothing inherently ambiguous in the terms at issue. None is "purely subjective," nor a "term of degree," nor does any state a benchmark (such as molecular weight) for which there may be more than one means of calculating. Without even referring to the specification or the prosecution history, it is evident from the claims that "in-band" is something separate and distinct from "out-of-band," especially since the claims require "in-band" and "out-of-band" communications to have a "relationship." If two things are not already separate and distinct, there would be no purpose served in requiring them to have a "relationship" to one another.

Early in the case, before Polar adopted its present position that the claims are indefinite, it was able to understand them. (A139-A147, Joint

Claim Construction and Prehearing Statement (proposed constructions at Exs. A and B).) Polar actually proposed specific constructions for each of the following: "**in-band** communication," "**in-band** bi-directional wireless communication device," "**in-band** communication using a bid-directional wireless protocol," "**out-of-band** communication," "**out-of-band** communication device," and "said **out-of-band** communication has a **relationship** to said **in-band** communication" (A143, A145-A146.) Polar later abandoned its proposed constructions, shifting solely to an indefiniteness argument. But before that happened, when confronted with the task of understanding the scope of the invention with reasonable certainty, there was a time when Polar was perfectly able to do so. Polar's position early in this case further demonstrates the clarity of the claims.

It is easy to understand why Polar retreated to indefiniteness: common-sense reading of the claims leaves no doubt about their scope. If a person of ordinary skill in the art[10] were to set out to build something outside the scope of the claims, he or she would understand first that he or she gets to *select* what constitutes the "in-band" starting point. Once that is

[10] The parties did not dispute the level of ordinary skill in the art. The district court made no findings on the subject.

done, "out-of-band" communications are those communications that are not "in-band." Where the district court erred is in concluding that "in-band" must be *dictated* rather than *selected*, and that the claims are indefinite unless the person of ordinary skill in the art is spoon-fed a limitation dictating the exact composition of "in-band" communications.

This overly restrictive read is inconsistent with the claims, and also conflicts with how these terms are used in the rest of the specification.

B. The remainder of the specification makes clear that "in-band" refers to one pathway, that "out-of-band" refers to a separate and distinct pathway, and how the two are related.

As envisioned in 2001, the inventors of the '351 patent imagined that "implementations of the present invention [would be] ubiquitous, appliance-like, and scaleable [sic]." (A62, '351 patent, col. 3, lines 36-37.) The latter two qualities do not impact the present dispute over whether "in-band," "out-of-band" and "relationship" render the claims indefinite, but the first—ubiquity—certainly does. Specifically, the inventors determined that "by providing *an inexpensive base controller for minimal 'in-band' communications*, the controller can be provided on virtually every exercise apparatus at minimal cost, leading to the ubiquitous nature of the invention." (*Id.*, col. 3, lines 38-41 (emphasis added); *see also* A69, '351

patent, col. 18, lines 45-56 ("A reason for 'in-band' base functionality is to make the basic controller ubiquitous to exercise equipment.").) In the many discussions of "in-band" and "out-of-band" that come later in the patent, it is evident that references to "out-of-band" are intended to describe an enhancement over "in-band," in that enhanced technology, something different in kind—something more complex, or more powerful, or more expensive—is required to facilitate "out-of-band" communications, interactions and experiences.

The discussions of "in-band" and "out-of-band" are primarily found in the description of Figures 13, 14 and 21 of the patent, although there are some references found in connection with Figures 29, 30 and 32.[11] Referring to Figure 13, reproduced below (in annotated form), the patent explains that the figure illustrates a preferred embodiment of "a remote interactive

[11] Text relating to Figures 13 and 14 begins at column 16, line 16, and ends at column 19, line 30. (A68-A70.) Text relating to Figure 21 begins at column 23, line 14, and ends at column 24, line 22. (A72.) Text relating to Figures 29 and 30 begins at column 26, line 46, and ends at column 27, line 63. (A73-A74.) Text relating to Figure 32 begins at column 28, line 19, and ends at line 35 of the same column. (A74.) The "in-band" concept is also touched upon briefly in the "Summary of the Invention" section, specifically at column 3, lines 36-41.

health and fitness system 250 [in orange]." (A68, '351 patent, col. 16, lines 16-18.)

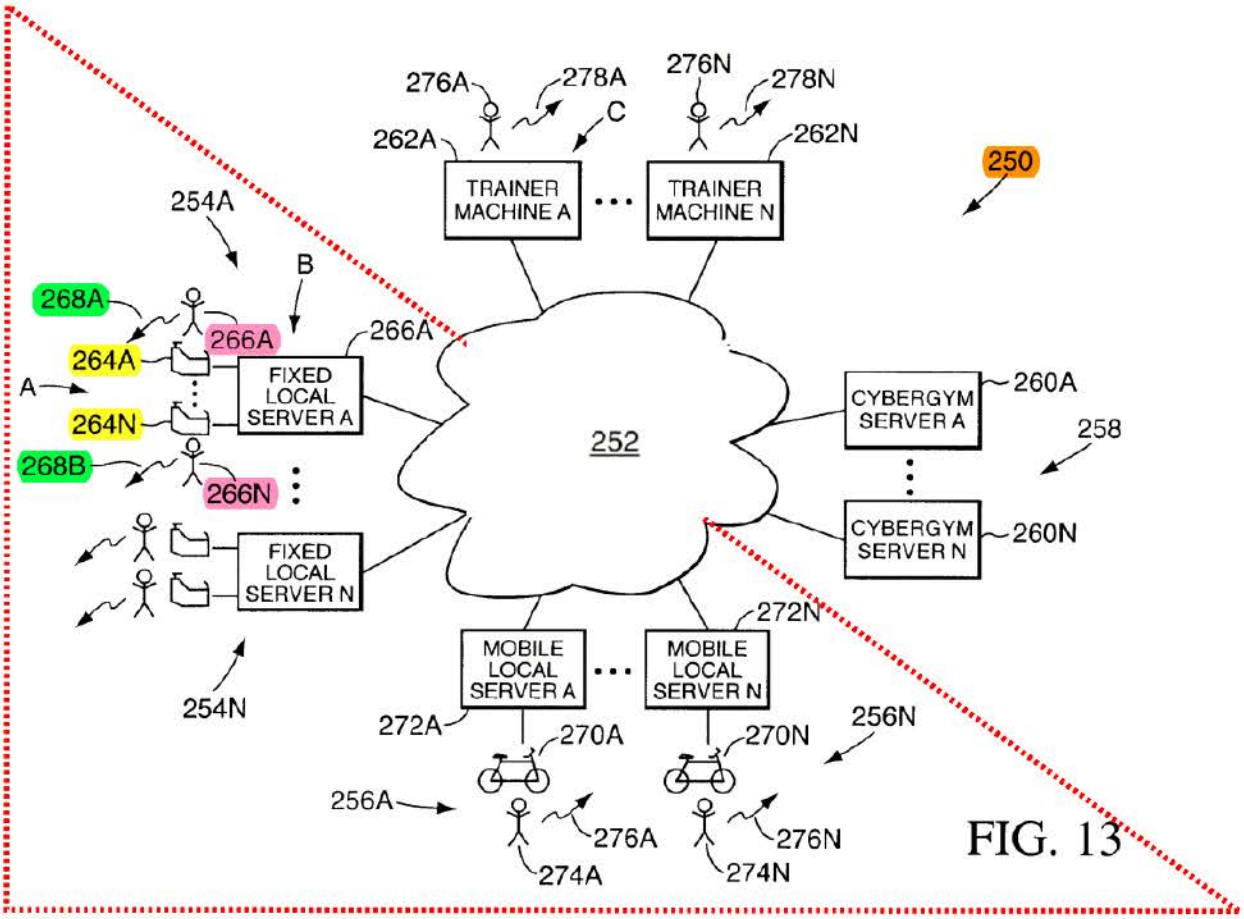

FIG. 13

The system 250 shown in this embodiment includes one or more fixed local systems (e.g., stationary bicycles) and/or mobile local systems (e.g., bicycles), which, together, comprise the "local system" component, shown within the red triangle, of the larger system 250. (*Id.*, col. 16, lines 20-23; *see also id.*, col. 16, lines 29-63 regarding fixed local system and A69, '351 patent, col. 17, lines 19-46 regarding mobile local system.)

"The system 250 also includes one or more trainer machines 262A-262N," shown at the top of the drawing, and "preferably includes a remote server 258," shown on the right hand side of the drawing. (A68, '351 patent, col. 16, lines 23-27.) Further, the embodiment shown in Figure 13 "may be implemented over a wide area network (WAN) such as the Internet 252," depicted by the cloud in the middle of the drawing. (*Id.*, col. 16, lines 18-20.)

The concepts of users' "in-band" and "out-of-band" interactions with the disclosed exercise system are first introduced in detail in connection with Figure 13. Referring again to the annotated version of Figure 13 provided above, the patent first establishes that "users 266A-266N [in pink] interact with the system 250 [in orange] at least through the exercise devices 264A-264N [in yellow]." (A68, '351 patent, col. 16, lines 51-53.) The patent then explains that "[s]uch interactions will be referred to herein as 'in-band' interactions." (*Id.*, col. 16, lines 53-54.) The patent then adds that these same "users 266A-266N [in pink] can also interact with the system 250 through 'out-of-band' interactions 268A-268B [in green]." (*Id.*, col. 16, lines 54-56.) "For example, a user 266A may be interacting with the fixed local server 266A on a separate, high speed data connection to provide *real*

time video information to the exercise device 264A." (*Id.*, col. 16, lines 58-61 (emphasis added).) The patent thus establishes at the outset that users can communicate with the system through both "in-band" and "out-of-band" interactions (and that these communications both relate to the same exercise session and consequently "ha[ve] a relationship to one another).

The patent further explains that "'out-of-band' interactions do not *necessarily* go through the Internet 252." (*Id.*, col. 16, lines 57-58 (emphasis added).) The implication is that "out-of-band" communications *can* go through the Internet, but they could also use other means and still be part of the system 250. "For example, a user 266A may be interacting with the fixed local server 266A on a separate, high speed data connection to provide real time video information to the exercise device 264A," or "the out-of-band interaction 268A could be a cellular phone conversation with a personal trainer." (*Id.*, col. 16, lines 58-63.) As the patent makes clear in its subsequent discussions, the distinction as to which communications are "in-band" and which are "out-of-band" is based on hardware and, correlatively, on pathway.

The following teachings from the '351 patent will help illustrate the "in-band"/"out-of-band" distinction. Together they show that a driving

force behind the invention was the idea of making the devices ubiquitous, which in turn required they be, at their core, simple and inexpensive. These simple devices allow only "in-band" interactions. But if consumers wanted something more, the patent provides for that as well by enabling "out-of-band" interactions via more expensive circuitry:

> [Referring to FIG. 14] A reason for "in-band" base functionality is to make the basic controller ubiquitous to exercise equipment. By making the base functionality whereby interaction with the sensors and actuators of the exercise equipment is supported, but not necessarily high-bandwidth interactions, the controller can be made very inexpensively and put into almost any exercise device with electronic circuitry. *The more expensive circuitry for high-bandwidth interactions can be provided separately with the "out of band" capabilities of the present invention.*

(A69, '351 patent, col. 18, lines 45-54 (emphasis added).) The above excerpt shows how the hardware necessary for "out-of-band" communication is not standard-issue; it is an optional enhancement available for those interested in, for example, "high-bandwidth interactions." Similarly, the excerpt below describes an "expanded version" of the local computer (*i.e.*, the one connected to one or more exercise devices), in which enhancements are provided to allow "out-of-band" communication:

> [Referring to FIG. 21] In an *expanded* version of the server 226A, there is also provided a mass storage device such as a hard disk

> drive 454, a graphics accelerator 456, and an out-of-band transceiver 458.

(A72, '351 patent, col. 23, lines 47-50 (emphasis added).) The "expanded version" is an upgrade over the stock server that has only an "in-band" transceiver. (*Id.*, col. 23, lines 30-46.) The excerpt below adds additional detail, explaining that an "out-of-band transceiver 458" is provided with the "expanded version" in order to handle, for example, "information [that] is of too high of a bandwidth for the preferred, low bandwidth in-band transceiver 450":

> [Referring to FIG. 21] The graphics accelerator 456 is useful for graphically driven outputs which, in a preferred embodiment, would be sent to a user by an out-of-band transceiver 458. For example, the user could use a wireless, headmounted display with display screens in front of each of his or her eyes as well as ear phones. This type of information is of too high of a bandwidth for the preferred, low bandwidth in-band transceiver 450, but could be handled by an out-of-band transceiver 458 transmitting on an antenna 460. By providing this form of out-of-band communication, high quality and stereo video information could be sent to a user, as well as high fidelity and stereo audio information. This information can be viewed on a television screen, a computer monitor, a headmounted display, a display associated with the exercise device, etc., by way of the out-of-band transceiver.

(A72, '351 patent, col. 23, line 59—col. 24, line 7.) Figure 21 itself, reproduced below, graphically depicts the separate nature of the hardware

required for respectively handling "in-band" versus "out-of-band" communications. The hardware to the left of the vertical dashed line is described as handling "in-band" communications (*id.*, col. 23, lines 14-46) while the hardware shown to the right is described as handling "out-of-band" communications (*id.*, col. 23, line 47—col. 24, line 22):

FIG. 21

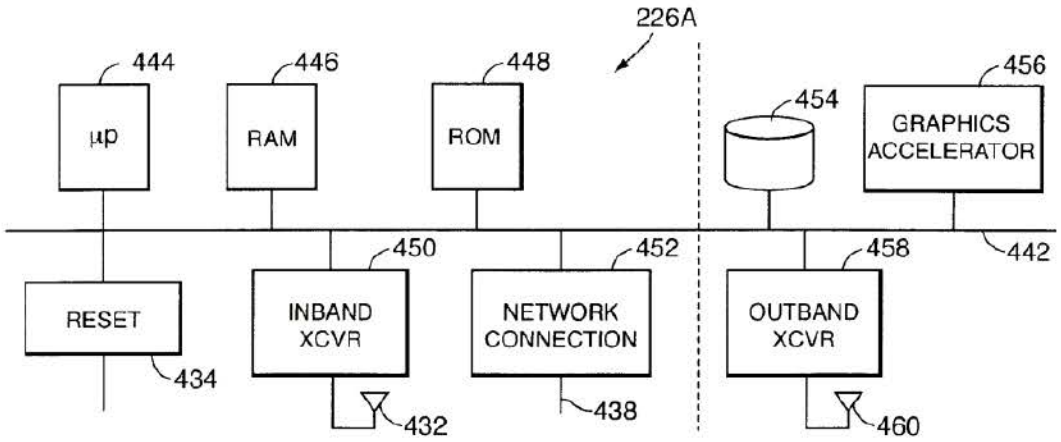

Figure 14 (reproduced below) further illustrates a controller having the expanded hardware necessary to process both "in-band" and "out-of-band" communications:

[Remainder of page intentionally left blank.]

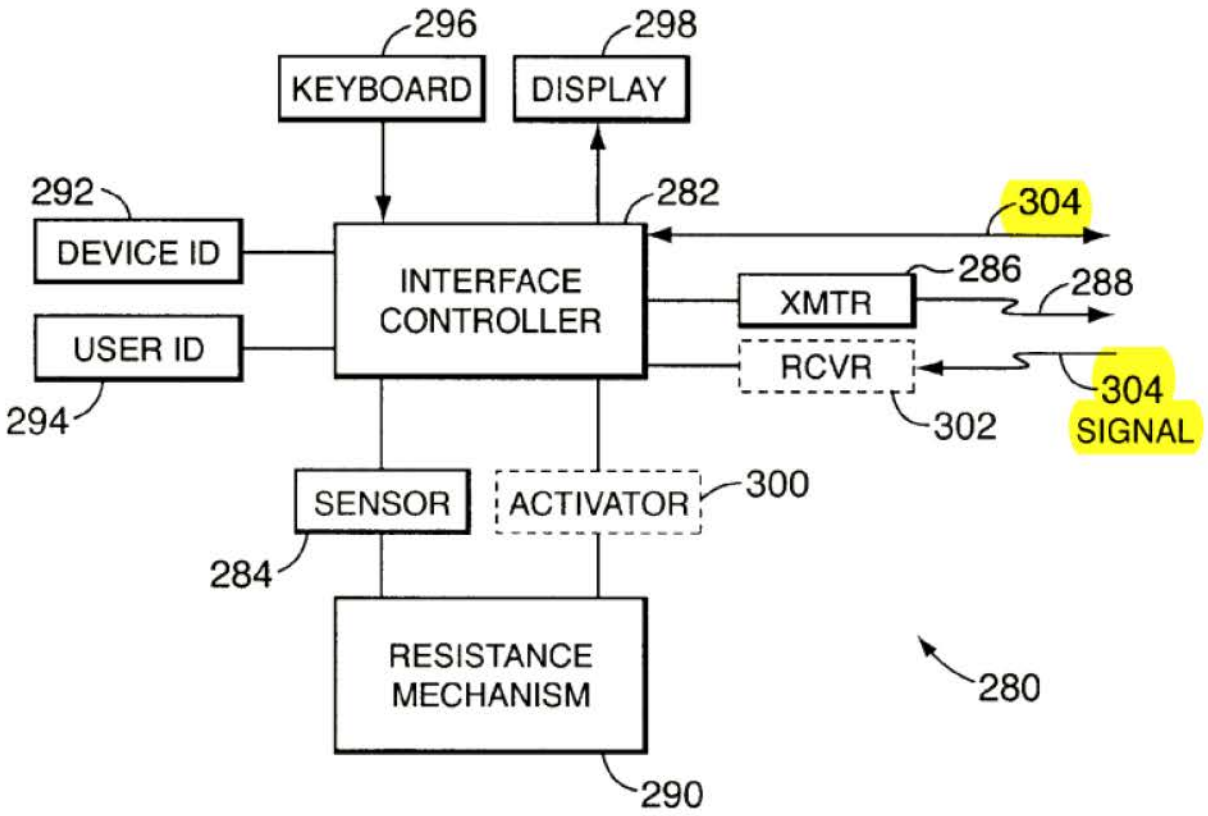

FIG. 14

Element 304 is generically described as "a signal [received] via a variety of transmission media including wired, wireless, optical, fiber optic, etc." (A69, '351 patent, col. 18, lines 42-44.) The patent goes to explain that it is envisioned that communications between the controller and the rest of the system would be of the "in-band" variety, capable of being handled by the inexpensive, standard-issue "in-band" hardware. The patent explains, however, that the signal 304 could also include "out-of-band" communications, and depicts two instances of signal 304 (both shown in

yellow) coming into the interface controller. This figure is consistent with the teachings discussed above that the standard-issue "in-band" hardware may be augmented with add-on hardware to process "out-of-band" communications.

The hardware-based distinction between "in-band" and "out-of-band" communications is further reinforced by the following excerpt:

> [Referring to FIG. 13] These users can interact with the system 250 by the "in-band" experience and/or by an out-of-band experience 276A-276N. Again, these out-of-band experiences can be high speed data connections to the local mobile computer *or true out-of-band experiences such as a cellular telephone conversation with the trainer*.

(A69, '351 patent, col. 17, lines 40-46 (emphasis added).) An "out-of-band" experience within the system 250 is different from a "true out-of-band experience[] such as a cellular telephone conversation with the trainer" because the latter takes place outside the claimed system, using none of the hardware described as comprising the system. But both are "out-of-band" because both require hardware over and above the standard-issue "in-band" hardware.

The inventors were prescient, however, and recognized that what is prohibitively expensive or complex today may be rudimentary tomorrow.

They consequently at times made note that communications that would otherwise be "out-of-band" may be provided "in-band" under the right conditions. That is, "[i]f a suitably powerful controller were provided in the exercise device, then all data transfers could be 'in-band,'"[12] including things such as stereo video and audio signals that would otherwise have to travel "out-of-band" if the device were equipped, as envisioned, only with "an inexpensive base controller for minimal 'in-band' communications."[13]

In this excerpt from the patent the inventors explain how this works:

> Of course, out-of-band interaction can also be performed in-band. In a preferred embodiment of the present invention, an inexpensive controller and interface providing low-data rate "in-band" transfers for an exercise device is seen to be preferable. Such a controller will add only minimally to the cost of the exercise device (which typically needs a controller anyway), permitting manufacturers to provide the "in-band" compatibility on virtually their entire product line. This "in-band" transfer is primarily a transfer of sensor data (from the exercise device) and scripts and other data to the exercise device. Other, high bandwidth transfers, such as streaming video and audio, etc., can be accomplished with an add-on "out of band" device. For example, a head mounted display and earphones can provide an out of band experience. *Nonetheless, other embodiments of the present invention utilizes [sic] a single, high-speed channel, such as an 802.11 protocol channel, to couple the*

[12] (A68, '351 patent, col. 17, line 16-18.)

[13] (A62, '351 patent, col. 3, lines 38-39.)

> *exercise device to the rest of the system. Of course, this would require a much more complex controller, approaching the complexity of a personal computer, to be provided for the exercise device. If a suitably powerful controller were provided in the exercise device, then all data transfers could be "in-band."*

(A68, '351 patent, col. 16, line 64—col. 17, line 18 (emphasis added).) In the following excerpt, the inventors again make clear that, with the proper hardware, all communications in the system can be processed by that hardware so that all communications are "in-band." In that scenario, no additional hardware is needed, so there are no "out-of-band" communications.

> *Of course, all communication can be "in band" if the investment is made in the hardware necessary to support high-bandwidth communication.* For example, the exercise equipment controller can include sufficient processing and peripheral power to utilize 802.11 wireless interconnections, which would provide enough bandwidth for completely "in-band" communications in certain embodiments of the invention.

(A72, '351 patent, col. 24, lines 15-22 (emphasis added).) The inventors understood that it may simply be a function of time and the inexorable advancement of processing power that eventually erases the distinction between "in-band" and "out-of-band." The patent was written in 2001, when transmitting complex data such as audio and video was fairly cumbersome, but the inventors looked forward to a day when what used to

require "out-of-band" add-ons could simply be handled in a single "in-band" connection:

> [Referring to FIG. 32] Preferably, the trainer 276A also has a trainer machine 262A that is provided with a video camera which would allow his or her image to be displayed at the exercise device, as long as it was provided with sufficient out-of-band devices. *Of course, as the capability of in-band transmission increases, this information may also be transmitted to the user via an in-band connection, as described above.*

(A74, '351 patent, col. 28, lines 29-35 (emphasis added).)

The written description makes clear in its use of the terms "in-band" and "out-of-band" that they are separate and distinct. Information that travels the "in-band" pathway is distinct from that which travels the "out-of-band" pathway in that each requires its own dedicated hardware components. The written description also makes clear, however, that there are no artificial boundaries imposed on what constitutes "in-band," except that information that cannot handled "in-band" must be handled, if at all, "out-of-band." If, on the other hand, the "in-band" hardware is robust enough to handle all communications, then there are no "out of-band" communications.

The claims do not purport to cover the latter situation. Every claim requires both "in-band" and "out-of-band" functionality. A person of

ordinary skill in the art, having digested the written description and reading the claims in light thereof would readily understand their scope with the "reasonable certainty" required by *Nautilus II*. A person of ordinary skill in the art would thus understand how to build a system having both "in-band communication" and "out-of-band communication," or an "in-band communication device" and an "out-of-band communication device," because the written description teaches how to distinguish between the two. Separate hardware is required for each, which means "in-band" and "out-of-band" communications must travel separate and distinct pathways, each utilizing its own hardware. The specification is likewise unambiguous in illustrating the nature of the "relationship" between "in-band" and "out-of-band." They are mutually exclusive and relate to the same exercise session.

C. The prosecution history confirms the claims, as amended to specifically to call out "in-band," "out-of-band" and "relationship," inform those skilled in the art about the scope of the invention with reasonable certainty.

As detailed in the "Statement of the Case" section, the claims were amended one time during prosecution, to overcome an anticipation rejection. (A618-A626, Amendment and Remarks.) The claims were

amended to specifically call out the "in-band"/"out-of-band" dichotomy, as well as the "relationship" between the two. (A619-A623.) None of these terms was present in the original claims; each was added by amendment as the point of distinction over the prior art. And the examiner's attention was specifically directed to these changes in the accompanying remarks. (A625.)

Perhaps coincidentally, perhaps not, the standard applied by examiners at the time of the amendment, October 2004, was essentially identical to the Supreme Court's current *Nautilus II* standard of whether the "claims, viewed in light of the specification and prosecution history, inform those skilled in the art about the scope of the invention with *reasonable certainty*." *Nautilus II*, 134 S. Ct. at 2129 (emphasis added). The standard for patent examiners (who, by vocation, are persons of at least ordinary skill in the art of the technology center in which they are employed) in reviewing claims for compliance with § 112, ¶ 2, is "whether the claims set out and circumscribe a particular subject matter with a *reasonable degree of clarity and particularity*." (A560-A561, § 2173.02 Manual of Patent Examining Procedure ("MPEP"), 8th ed., Rev. 2, May 2004, at 2100-205 (emphasis added).)

In applying this standard, the patent examiners of 2004 were specifically instructed that:

> Definiteness of claim language must be analyzed, not in a vacuum, but in light of:
> (A) The content of the particular application disclosure;
> (B) The teachings of the prior art; and
> (C) The claim interpretation that would be given by one possessing the ordinary level of skill in the pertinent art at the time the invention was made.

(*Id.*) The examiner of the application for the '351 thus was fully confronted with question of whether the claims, as specifically amended to distinguish over the prior art on the basis of "in-band," "out-of-band" and "relationship," were reasonably clear in light of teachings of the specification and the prior art, and in light of the understanding of a person of ordinary skill in the art. Clearly he did because his next act was to allow the claims, as amended. (A628-A631, Notice of Allowance.)

The prosecution history compellingly shows the clarity of the terms at issue when read in context and from the proper point of view. Notably, the examiner had only to be convinced of prima facie indefiniteness in order to issue a rejection. *In re Packard*, 751 F.3d 1307, 1312-1313 (Fed. Cir. 2014) ("It makes good sense, for definiteness and clarity as for other validity requirements, for the USPTO initially to reject claims based on a

well-founded prima facie case of lack of clarity (in its several forms) based on the perspective of one of ordinary skill in the art in view of the entire written description and developing prosecution history.") That the district court found clear and convincing evidence of indefiniteness applying essentially the same "reasonable certainty" standard suggests strongly that the district court erred.

III. This appeal should be limited to de novo review because the intrinsic record is clear and the material facts are undisputed.

In the present case, the district court received evidence from experts, i.e., extrinsic evidence. (Statement of the Case at 19.) However, based on the discussion presented above, the intrinsic record is sufficient on its own to inform those of skill in the art regarding the scope of the claims. In that circumstance, the extrinsic evidence adds nothing to the discussion, so it is "ultimately immaterial." *Eidos*, 779 F.3d at 1365 (Fed. Cir. 2015) ("To the extent the district court considered extrinsic evidence in its claim construction order or summary judgment order, that evidence is ultimately immaterial to the outcome because the intrinsic record is clear."). Consequently, when "the meaning of the claim at issue is clear in view of

the intrinsic record and undisputed facts, we also review de novo." *Eidos*, 779 F.3d at 1364-1365 (*citing Teva II*, 135 S. Ct. at 840-842).

In terms of facts relevant to how a person of ordinary skill in the art at the time of the invention would have understood "in-band" and "out-of-band," there are really only two, and they are undisputed. At the evidentiary hearing, Dr. Heppe testified repeatedly that he and Icon's expert Dr. Islam are in agreement that people generally understand the terms "in-band" and "out-of-band" and that they are understood as being separate and distinct from one another:

> So the point of this discussion is that people do have an understanding of what in-band and out-of-band mean in the general sense, as Dr. Islam [Icon's expert] said. Dr. Islam also made very clear that people treat in-band and out-of-band as distinct and separate, and I fully agree with that.

(A2152, 2/27/15 Hrg. Tr. at 75:12-16.)

> Now, so Dr. Islam made the point that people understand in-band and out-of-band are distinct from one another. And as I said, I fully agree with that -- with that statement. They are distinct.

(A2155, 2/27/15 Hrg. Tr. at 78:16-19.)

> … in-band and out-of-band should be distinct. Dr. Islam agrees, he testified to that multiple times today.

(A2159, 2/27/15 Hrg. Tr. at 82:5-7.)

Polar's expert continued by arguing the terms have no meaning unless there is prior agreement as to what constitutes "in-band," but that is dealt with in the next section as "testimony that is clearly at odds with claim construction mandated by the claims themselves, the written description, and the prosecution history." *Phillips*, 415 F.3d at 1318 (citation and quotation marks omitted). As to facts material to the meaning of these terms as used in the '351 patent, there are no disputes.

Thus, given the clarity of the intrinsic record and the fact that all parties agree that "in-band" and "out-of-band" are generally understood terms and that they are distinct and separate from one another, de novo review is all that is warranted here. The scope of the claims is ascertainable with reasonable certainty in light of the clear intrinsic record described above, and the undisputed facts on which the parties agree

IV. There are no factual determinations to review for clear error.

The Supreme Court confirmed in *Teva II* that claim construction is a question of law, reviewed de novo, but that claim construction may require subsidiary findings of fact by the district court, and that these findings of fact are to be reviewed for clear error. *Teva II*, 135 S. Ct. at 841. But in considering whether, and to what, to apply the clear error review, two

important points must be remembered: First, just because the expert says it does not make it a fact issue. "A party cannot transform into a factual matter the internal coherence and context assessment of the patent simply by having an expert offer an opinion on it." *Teva Pharm. USA, Inc. v. Sandoz, Inc. (Teva III)*, 789 F.3d 1335, 1342 (2015). In other words, if an expert improperly opines on the legal issue of claim scope, and the district court adopts that expert's opinion, there have been no findings of fact and review therefore remains de novo. Second, the expert does not get the last word. *Teva II* requires the district court, after resolving the fact issue to its satisfaction, to then perform a legal analysis to determine "whether a skilled artisan would ascribe that same meaning to that term *in the context of the specific patent claim under review*." *Id.* (emphasis in original). Each of these points is implicated in the present appeal, and each is addressed below.

A. The district court relied on Polar's expert for his legal analysis, so there are no subsidiary fact issues to be reviewed for clear error.

The proper scope of expert testimony in connection with claim construction (and therefore indefiniteness) includes "for example, the background science or the meaning of a term in the relevant art during the

relevant time period." *Teva II*, 135 S. Ct. at 841. "Experts may explain terms of art and the state of the art at any given time, but they cannot be used to prove the legal construction of a writing." *Teva III*, 789 F.3d at 1339 (*citing Teva II*, 135 S. Ct. at 841). This is because "[t]he internal coherence and context assessment of the patent, and whether it conveys claim meaning with reasonable certainty, are questions of law." *Teva III*, 789 F.3d at 1342. Thus the meaning a person of skill in the art would attribute to "in-band" and "out-of-band" in light of their use in the claims, the specification, and the prosecution history is a question of law. *Id*. Polar cannot transform it into a fact issue reviewed for clear error simply by having its expert opine on the subject. *Id*. ("A party cannot transform into a factual matter the internal coherence and context assessment of the patent simply by having an expert offer an opinion on it.").

The overwhelming majority of Dr. Heppe's testimony expressly engages in an analysis of the meaning of the disputed claim terms in light of the specification and prosecution history. (*See* ¶¶ 54-105 and 118 of the Heppe Decl. (A883-A908, A913-A916) and pages 83-102 of the 2/27/15 Hrg. Tr. (A2160-A2179).) Indeed, Dr. Heppe's "Summary" at the end of his declaration states that he is "[s]ummarizing [his] analysis of 'in-band

communication' and 'out-of-band communication' *as used in the '351 patent*." (A913, Heppe Decl., ¶ 118 (emphasis added).)

In its Opinion, the district court cited liberally to Dr. Heppe's legal analysis. (*See* A13-A17, A22-A24, Opinion at 12-16, 21-23.) But doing so does not transform claim construction into factual matter. *Teva III*, 789 F.3d at 1342. Nor does reliance on an expert automatically invoke the clear error standard.

Here, the district court did not rely on expert testimony on questions of fact, only as to questions of law. There are consequently no subsidiary findings of fact to be reviewed for clear error. There is only the district court's internal coherence and context assessment of the patent, and whether it conveys claim meaning with reasonable certainty, which are questions of law subject only to de novo review on appeal.

B. Alternatively, the issue of whether the district court erred in adopting Dr. Heppe's opinion on the meaning of the claim terms is a question of law reviewed de novo.

Assuming, for the sake of argument only, that the district court correctly resolved a factual dispute in selecting Dr. Heppe's views regarding the meaning of the disputed claim terms, clear error review is not automatically triggered. The district court's analysis of whether the

adopted finding is consistent with the context of the patent remains a legal question:

> For example, if a district court resolves a dispute between experts and makes a factual finding that, in general, a certain term of art had a particular meaning to a person of ordinary skill in the art at the time of the invention, the district court must then conduct a legal analysis: whether a skilled artisan would ascribe that same meaning to that term *in the context of the specific patent claim under review*.

Teva II, 135 S. Ct. at 841 (emphasis in original).

After deciding the factual dispute, the district judge must still "interpret the patent claim in light of the facts as he has found them." *Id.* "This ultimate interpretation is a legal conclusion." *Id.* "The appellate court can still review the district court's ultimate construction of the claim de novo." *Id.* Thus de novo review, not clear error review, is the standard to be applied in deciding whether the district court properly applied the facts as it found them to the legal matter of construing the claims.

In the present case, de novo review shows the district court erred in adopting Dr. Heppe's views because they are clearly at odds with claim construction mandated by the claims themselves, the written description, and the prosecution history. *See Phillips*, 415 F.3d at 1318.

Dr. Heppe advocated that persons of ordinary skill in the art generally understood "in-band" and "out-of-band" in 2001 and understood them to be separate and distinct, but that that such persons would have no way of knowing what is "out-of-band" without first being told what is "in-band." (A2152-A2153, 2/27/15 Hrg. Tr. at 75:12—76:1.) Dr. Heppe generally described the issue as "in-band" and "out-of-band" being relative terms that require a reference. (A2159, 2/27/15 Hrg. Tr. at 82:8-11.) The district court adopted that position. (A19, Opinion at 18.)

Assuming, again for the sake of argument only, that Dr. Heppe is correct, there is simply no support for the proposition that the inventors of the '351 patent were using these terms in this overly-restrictive way. As the discussion in Section II, above, makes clear, the inventors describe a system in which all devices come equipped with the hardware necessary to process "in-band" communications, and that additional hardware is required to process "out-of-band" communications. It is undisputed that a person of ordinary skill in the art would understand the difference, and that is all the claims require. Neither the claims, nor the specification, nor the prosecution history suggests any need to go any further in defining

these terms. Certainly nothing suggests a person of ordinary skill in the art would be left dumbstruck unless "in-band" is specifically defined.

Even if Dr. Heppe were correct in his views as to how persons of skill in the art used these terms in 2001 outside the context of the patent, his definition conflicts with the patent's intrinsic record and should have been discounted accordingly. *Phillips*, 415 F.3d at 1318 ("[A] court should discount any expert testimony that is clearly at odds with the claim construction mandated by the claims themselves, the written description, and the prosecution history, in other words, with the written record of the patent.") (citation and quotation marks omitted).

Whether the district court resolved an issue of fact, and whether it did so correctly, are immaterial if it erred as a legal matter in applying the facts as decided to claim construction process. The district court so erred here.

V. Alternatively, the district court's findings of fact were clearly erroneous.

Assuming, for the sake of argument, that the district court correctly considered extrinsic evidence, despite having a clear intrinsic record, and correctly applied Dr. Heppe's views on "in-band" and "out-of-band,"

despite their obvious incongruity with intrinsic record, the district court clearly erred in siding with Dr. Heppe that a person of ordinary skill in the art would not understand "in-band" and "out-of-band" unless that person is first provided a specific reference for what constitutes "in-band."

Most of Dr. Heppe's views (those not engaging in legal analysis of the intrinsic record) are unsupported and conclusory. He provides a thirty-paragraph rambling discussion covering a number of esoteric topics, but shows no support for the proposition that persons of skill in the art in 2001 were incapable of building something having "in-band" and "out-of-band" communications unless first defining "in-band." (A867-A882, Heppe Decl. at ¶¶ 19-49.) What his examples show—indeed what all the examples show—is that a person of ordinary skill in the art *selects* the "in-band" reference and understands everything else is "out-of-band." To build a system having "in-band" and "out-of-band" capabilities, a person of ordinary skill in the art does not sit helplessly waiting to be told what is "in-band." Dr. Heppe takes the opposite position, but cites nothing that agrees with him.

The single reference Dr. Heppe points to is a technical dictionary from the Institute of Electrical and Electronics Engineers, defining "in-band

signaling" and "out-of-band signaling." (A882-A883, Heppe Decl., ¶¶ 50-52.) This dictionary provides several definitions, but none supports the idea that a person of ordinary skill in the art in 2001 would be unable to distinguish "in-band" from "out-of-band" unless "in-band" is first defined.

Indeed, Dr. Heppe's testimony in this regard is somewhat absurd. It presupposes that a person of skill in the art is an automaton incapable of logic or reason. The notion that a person could understand "in-band" and "out-of-band" generally, and understand they are separate and distinct, but be incapable of *selecting* the "in-band" starting point rather than *receiving* it spoon-fed, simply collapses under its own weight.

Icon's expert, on the other hand, posited a much more common-sense definition, that "'in-band' refers to one pathway, and 'out-of-band' refers to a different pathway." (A964, Islam Decl., Ex. A, p. 18.) Dr. Islam cited seven patents and five textbooks from 2001 as support for this proposition. (A964-A973.)

There was simply no basis for the district court to side with Dr. Heppe and in doing so, the district court clearly erred.

CONCLUSION

The claims of the '351 patent, viewed in light of the specification and the prosecution history, inform those of ordinary skill in the art of the scope of the invention with reasonable certainty.

Icon respectfully requests that the district court's finding of indefiniteness be reversed, that the judgment against Icon on Icon's claim against Polar for patent infringement be vacated, and that this case be remanded for further proceedings.

Respectfully submitted,

/s/ R. Parrish Freeman

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DATED: October 2, 2015

ADDENDUM

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Order Granting Motion for Entry of Judgment Under Rule 54(b).	A25-A27
U.S. Patent No. 6,921,351	A28-A76

AO 450 (Rev.5/85) Judgment in a Civil Case

United States District Court

Northern Division for the District of Utah

ICON HEALTH & FITNESS, a Delaware corporation,

Plaintiff

v.

POLAR ELECTRO OY, a Finnish company and POLAR ELECTRO INC., a Delaware corporation,

Defendants

JUDGMENT IN A CIVIL CASE

Case Number:1:11-CV-167-BSJ

IT IS ORDERED AND ADJUDGED

That final judgment be entered, pursuant to FRCP 54(b), in favor the defendant on plaintiff's third claim for relief for infringement of the '351 patent which is dismissed with prejudice.

July 9, 2015
Date

D. Mark Jones
Clerk of Court

(By) Deputy Clerk

IN THE UNITED STATES DISTRICT COURT
DISTRICT OF UTAH, CENTRAL DIVISION

ICON HEALTH & FITNESS, INC., Plaintiff, v. POLAR ELECTRO OY et al., Defendants.	MEMORANDUM OPINION & ORDER REGARDING CLAIM CONSTRUCTION Case No.: 1:11-cv-00167-BSJ Honorable Bruce S. Jenkins

I. Procedural History

On November 18, 2011, ICON Health & Fitness, Inc. ("ICON") filed a Complaint against Polar Electro Oy. ("Polar Oy") asserting infringement of U.S. Patent No. 7,789,800 ("'800 patent") and U.S. Patent No. 6,701,271 ("'271 patent"). (Dkt. No. 1). On June 8, 2012, ICON filed an amended complaint against Polar Oy and Polar Electro, Inc. ("Polar Inc.") (collectively "Polar") asserting infringement of the '800 patent, the '271 patent, and an additional patent, U.S. No. 6,921,351 ("'351 patent). (Dkt. No. 9). The case was stayed with respect to the '800 patent and the '271 patent pending finalization of reexamination proceedings for those patents. (Dkt. No. 51).

On January 10, 2014, the Court held a Markman hearing to hear arguments on proposed claim constructions for asserted claims 1 and 5 of the '351 patent, including the terms "in-band communication," "out-of-band communication," "out of-band device," and the claimed "relationship" between the out-of-band communication and the in-band communication. (*See, e.g.*, Dkt Nos. 58, 69, 71). In light of *Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S.Ct. 2120

(2014), the court heard re-argument on August 21, 2014, which was followed by supplemental briefing. (*See, e.g.*, Dkt Nos. 77, 78).

The Court thereafter requested the assistance of those skilled in the art to aid in the construction of the claim terms and ordered the parties to designate experts and conduct expert discovery. (Dkt No. 81). Following the close of expert discovery Polar filed a motion for partial summary judgment of invalidity based on the '351 patent's failure to define the claimed "relationship" for those skilled in the art with reasonable certainty. (Dkt Nos. 84, 97-100). ICON thereafter filed an additional expert declaration. (Dkt No. 87). Polar moved to strike the additional expert declaration. (*See* Dkt. Nos. 89 – 94).

The parties filed supplemental claim construction briefs on February 13, 2015. (Dkt Nos. 85, 86). The court held an evidentiary hearing on February 27, 2015 to hear expert testimony from the parties' respective experts, followed by oral argument on March 30, 2015 focusing on the terms "in-band communication," "out-of-band communication," "out of-band device," and the claimed "relationship" between the out-of-band communication and the in-band communication.

The issue before the Court is broader than the limited summary judgment filed by Polar. It involves the broader subject of whether the claims are genuinely capable of construction, with all do deference to the U.S. Patent and Trademark Office and presumption of validity provided by 35 U.S.C. § 282. The Court therefore addresses the broader issue of validity in accordance with its duty as the construer of the patent claims.[1]

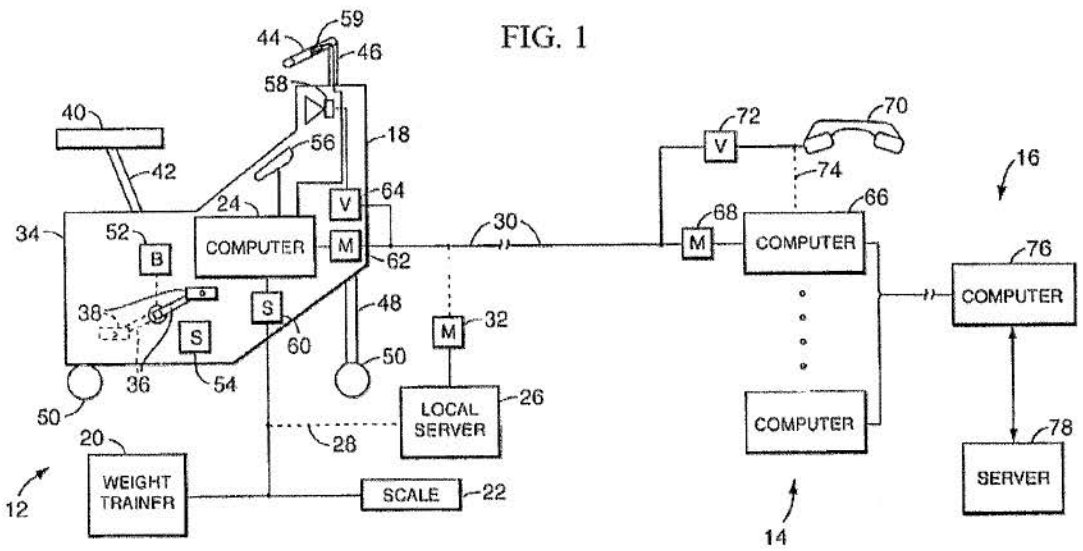
[1]At the close of the March 30, 2015 hearing, after orally ruling that the '351 patent was invalid for indefiniteness, the court specifically reserved the right to alter or add to its oral ruling in its final written order. *See* Hr'g 3/30/15 Tr., (CM/ECF No. 104), 4:19-5:2. Such additions are reflected in this written opinion.

II. The '351 Patent

A. Summary of the '351 Patent

The '351 patent discloses an exercise and health system that includes computerized exercise and/or health equipment. (Dkt. No. 77-2, p. 35 of 50, '351 patent, col. 2:22-25). Figure 1 of the '351 patent shown below is an example of the patent's computer network exercise system. (*Id.*, p. 36 of 50, '351 patent, col. 3:59-60). In Figure 1, a computer 24 in bicycle 18 is connected by a line 30 (which can be the Internet) to a remote computer 66, which is connected to server station 16. (*Id.*, p. 38 of 50, '351 patent, col. 7:33-37; col. 8:14-16). The '351 patent divides its system into two parts: a local system 12 on the left hand side of line 30, (*Id.*, p. 37 of 50, '351 patent, col. 5:14-15), and a remote system on the right hand side of line 30. *Id.*, p. 37 of 50, '351 patent, col. 5:14-16). The local system 12 "can provide feedback and encouragement to the user, i.e. can serve as a 'virtual personal trainer.'" (*Id.*, p. 35 of 50, '351 patent, col. 2:23-28, 36-38).

FIG. 1



The local system 12 also includes two subparts: an exercise device such as a stationary bicycle 18 with a computer 24; (Dkt. No. 77-2, p. 37 of 50, '351 patent, col. 5:37-41) and a local

server, such as 26 shown above in Figure 1. The '351 patent discloses that the local server 26 need not be a separate computer. (*Id.*, p. 37 of 50, '351 patent, col. 5:45-57). For example, in the preferred embodiment, the computer 24 plays a dual role: the computer for bicycle 18, and "a 'local server' for other health and fitness devices at local system 12, such as the weight trainer 20 and the scale 22." (*Id.*, p. 37 of 50, '351 patent, col. 5:45-57).

Figure 13 shows another embodiment of the computer network exercise system. (Dkt. No. 77-2, p. 42 of 50, '351 patent, col. 16:16-20). The '351 patent describes it as "a remote interactive exercise and health system in accordance with the present invention." (*Id.*, p. 36 of 50, '351 patent, col. 4:22-23).

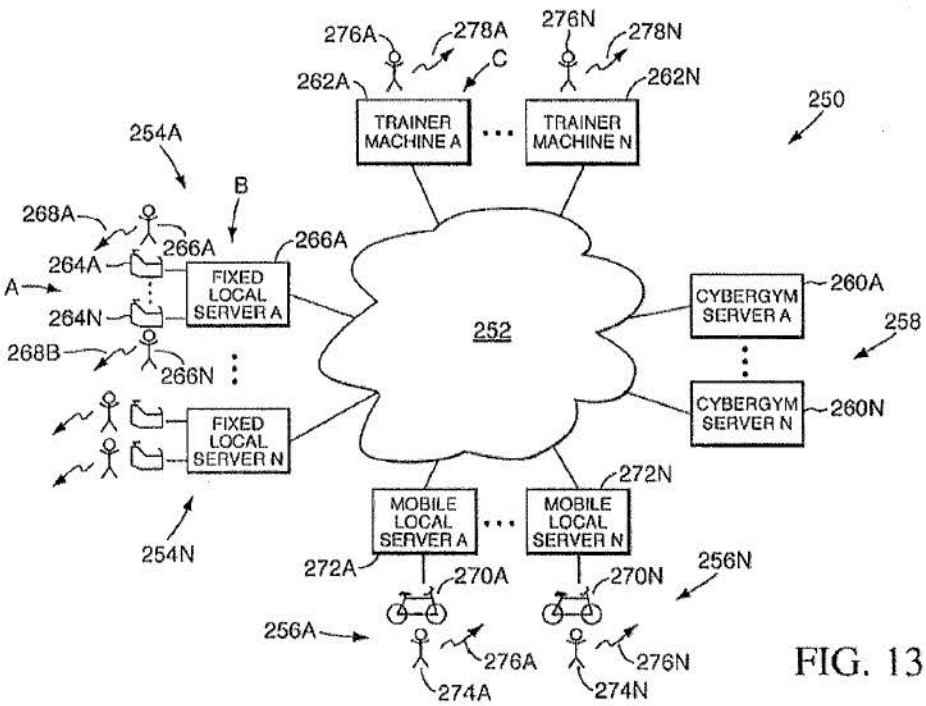


FIG. 13

While this embodiment has additional features, it also has the basic two parts of the Figure 1 network: local systems and remote servers. (Dkt. No. 77-2, p. 42 of 50, '351 patent, col. 16:20-24). The local servers are connected through the Internet (252) to remote servers (260A - 260N).

(*Id.*, col. 16:20-26; col. 16:39-41; Dkt. 77-2, p. 43 of 50, '351 patent, col. 17:47-49). Two additional features of this embodiment compared to Figure 1 are mobile exercise devices, like bicycle 270A, and trainer machines (262A - 262N) staffed by trainers (276A - 276N). (*Id.*, p. 43 of 50, '351 patent, col. 17:19-21, 61-62).

Figure 14 is a block diagram of an exercise device circuit which can be associated with, for example, an exercise device 264A-264N or 270A-270N. (Dkt. No. 77-2, p. 43 of 50, '351 patent, col. 18:28-32). An exercise device controller 280 includes an interface controller 282. (*Id.*).

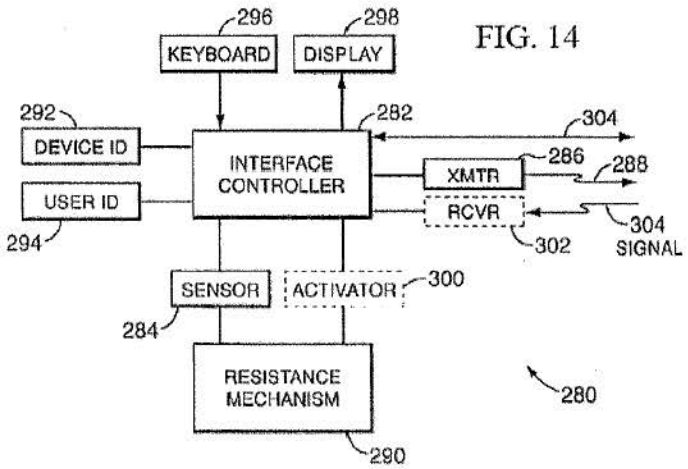


FIG. 14

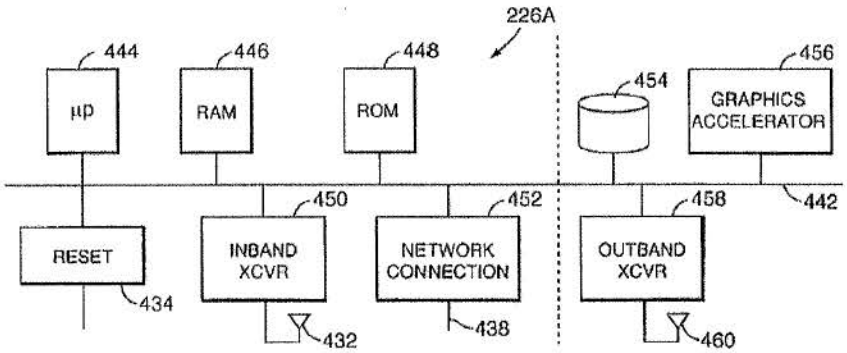
The '351 patent explains the in-band and out-of-band communications between the interface controller 282 and the rest of the system stating

> [c]ommunications between the interface controller and the rest of the system 250 through the transmitter 286 and the optional receiver 302 comprise "***in-band***" communication. However, there can also be ***out-of-band*** communication signals 304 between the controller 280 and, for example, a local server 266A. These "***out-of-band***" signals can include, for example, high speed data communication to provide real time video (e.g. streaming video over the Internet) on the display 298.
> (*Id.*, p. 44 of 50, '351 patent, col. 19:22-30 (emphasis added)).

By this passage, the '351 patent teaches that there can be out-of-band communication signals between exercise device controller 280 and the local server 266A. (*See also* February 27, 2015 Hearing Transcript, p. 25:8 – p. 26:15; p. 86:16 – p. 87:10).

Figure 21 shows a typical computer architecture for a server 226A. (Dkt. No. 77-2, p. 46 of 50, '351 patent, col. 23:14-15). The out-of-band transceiver 458 is shown as a wireless transceiver. (*Id.*, col. 24:7-8).

FIG. 21



These passages of the '351 patent teach that out-of-band communications can be wireless. (*See also* February 27, 2015 Hearing Transcript, p. 87:22-25)

B. Summary of the ''351 Patent Prosecution History

The '351 patent was filed on October 19, 2001. (Dkt. No. 77-2, p. 2 of 50). By an Office action dated June 15, 2004, all pending claims were rejected under 35 U.S.C. 102(b) as being anticipated by Watterson. (Dkt. No. 77-3, p. 4 of 5). In response, the applicants amended claim 1 from its original text of "said exercise apparatus and said local server communicating with a bi-directional wireless protocol," by making the changes shown below.

1. (currently amended) An exercise system comprising:

a local system including at least one exercise apparatus and at least one associated local server, said at least one local server monitoring the operation of said at least one exercise apparatus, said exercise apparatus and said local server having an in-band communication using ~~communicating with~~ a bi-directional wireless protocol;

an out-of-band communication with a user of said at least one exercise apparatus, wherein said out-of-band communication has a relationship to said in-band communication;

(Dkt. No. 77-4, p. 3 of 10).

The applicants also amended claim 5 from its original text of "at least one exercise apparatus having a bi-directional wireless communication device," by making the changes shown below.

5. (currently amended) An exercise system comprising:

at least one exercise apparatus having ~~a~~ an in-band bi-directional wireless communication device;

an out-of-band communication device capable of a communication with a user of said at least one exercise apparatus that has a relationship to said in-band communication;

(*Id.*, p. 4 of 10)

The applicants argued that Watterson did not anticipate the amended claims, stating.

One of the aspects of an embodiment of Applicant is the use of in-band communication in conjunction with out-of-band communication in an exercise system. See, for example, Applicant's Fig. 13 and accompanying description on page 28, lines 19-29. Watterson '060 does not hint of such a combination. Another aspect is the wireless communication between an exercise device with an exercise device ID. Again, there is no disclosure of such a combination with Watterson '060. Applicant therefore respectfully requests that the rejections based upon Watterson '060 be withdrawn.

(*Id.*, p. 9 of 10)

The application was then allowed for issuance as a patent (Dkt. No. 77-5), and the '351 patent issued on July 26, 2005. (Dkt. No. 77-2, p. 2 of 50).

III. Legal Standards

Claim construction is a question of law. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed. Cir. 1995) (*en banc*). The Court determines the meaning of disputed claim terms as understood by one of ordinary skill in the art at the time of the invention. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-13 (Fed. Cir. 2005) (*en banc*). Claim terms generally should be given their ordinary and customary meaning to a person of skill in the art at the time of the invention. *See id.* To determine the ordinary meaning, the Court first looks to the intrinsic evidence, which includes the claims, the specification and the prosecution history (i.e., the history of the proceedings before the United States Patent and Trademark Office). *See id.* at 1312-1317.

The claim language is the starting point for claim interpretation, and can "provide substantial guidance as to the meaning of particular claim terms." *Id.* at 1314. The differences between claims also can assist the Court in construing claim terms. *Id.* Extrinsic evidence, such as dictionaries, also may be consulted by a Court to assist it in understanding the disputed terms. *Id.* at 1318.

"A determination of claim indefiniteness is a legal conclusion that is drawn from the court's performance of its duty as the construer of patent claims." *Personalized Media Communications, LLC v. Int'l Trade Comm'n*, 161 F.3d 696, 705 (Fed. Cir. 1998). In *Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S.Ct. 2120, 2130 (2014), the Supreme Court rejected a standard that allowed indefiniteness up to "insolubly ambiguous," stating

> To tolerate imprecision just short of that rendering a claim "insolubly ambiguous" would diminish the definiteness requirement's public-notice function and foster the innovation-discouraging "zone of uncertainty," *Union Carbide*, 317 U.S. [228], at 236, against which this Court has warned.
>
> *Id.*

The Supreme Court rested its decision on the Patent Act's statutory requirement of clarity and precision, stating

> The Patent Act requires that a patent specification "conclude with one or more claims *particularly pointing out and distinctly claiming* the subject matter which the applicant regards as [the] invention." 35 U.S.C. § 112, ¶ 2 . . . This case . . . concerns the proper reading of the statute's clarity and precision demand.
>
> *Id.* at 2124 (emphasis in original).

Accordingly, the Supreme Court reigned in the tolerated ambiguity from "insolubly ambiguous," to requiring claim language that defines the invention for those skilled in the art with "reasonable certainty," stating

> a patent's claims, viewed in light of the specification and prosecution history, inform those skilled in the art about the scope of the invention with reasonable certainty.
>
> *Id.* at 2129.

The Supreme Court in *Nautilus* held that "[i]t cannot be sufficient that a court can ascribe *some* meaning to a patent's claims; the definiteness inquiry trains on the understanding of a skilled artisan at the time of the patent application, not that of a court viewing matters *post hoc*. To tolerate imprecision just short of that rendering a claim 'insolubly ambiguous' would diminish the definiteness requirement's public-notice function and foster the innovation-discouraging 'zone of uncertainty.'" *Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S. Ct. at 2130, *quoting* United Carbon Co. v. Binney & Smith Co., 317 U.S. 228, 236 (1942) (emphasis in original).

To satisfy the definiteness standard, the "claims, when read in light of the specification and the prosecution history, must provide objective boundaries for those of skill in the art."

Interval Licensing LLC v. AOL, Inc., 766 F.3d 1364, 1371 (Fed. Cir. 2014) (quoting *Nautilus*, 134 S.Ct., at 2130). That is, a "patent's claims, viewed in light of the specification and prosecution history, [must] inform those skilled in the art about the scope of the invention with reasonable certainty." *Nautilus*, 134 S.Ct. at 2129. Thus, a claim is invalid if it fails to define the invention with reasonable certainty for those skilled in the art. *Id.* at 2124.

When interpreting claim terms, claim terms "cannot be interpreted differently in different claims because claim terms must be interpreted consistently." *Southwall Technologies, Inc. v. Cardinal IG Company*, 54 F.3d 1570, 1579 (Fed. Cir. 1995), *citing Fonar Corp. v. Johnson & Johnson*, 821 F.2d 627, 632 (Fed. Cir. 1987).

IV. Analysis

In construing a patent claim, the court looks first to intrinsic evidence of record, i.e. the patent itself, including all claims as the most significant source of the legally operative meaning of disputed claim language. *See Phillips*, 415 F.3d at 1314. In this case, however, given the language of the claims and the discussion of the technology in the specification, that exercise proved to be daunting. The Court therefore requested the parties to offer the views of their respective experts so as to provide a substantive footing to assist the Court in trying to adequately construe the claims, particularly in light of the question of indefiniteness being assessed from the viewpoint of one of skill in the art. The Court found the testimony by the experts quite helpful, particularly because "definiteness is to be evaluated from the perspective of one skilled in the relevant art." *Nautilus*, 134 S.Ct. at 2128. Each expert purported to proffer the same testimony that he would offer at trial.

A. In-Band Communication and Out-Of-Band Communication

The claim terms "in-band communication" and "out-of-band communication" appear in both claim 1 and claim 5 of the '351 patent. The following table shows the relevant claim language, with the claim terms in italics.

Claim 1	Claim 5
said exercise apparatus and said local server having ***an in-band communication*** using a bid-directional wireless protocol;[2]	at least one exercise apparatus having an ***in-band bi-directional wireless communication device***;
an out-of-band communication with a user of said at least one exercise apparatus,	an ***out-of-band communication*** device capable of a communication with a user of said at least one exercise apparatus ***that has a relationship to said in-band communication***
wherein said ***out-of-band communication has a relationship to said in-band communication***;	

1. The Interchangeable Use of "Communication," "Experience," and "Interaction"

The claim terms "in-band communication" and "out-of-band communication" both use the term "communication. The '351 patent uses the terms "communication," "experience," and "interaction" in an apparently interchangeable manner. For example, the '351 patent calls the "true out-of-band" an "experience," and then provides a cellular call between a user and a personal trainer as an example. Such a telephone call between the user and the personal trainer is also referred to as an "out-of-band communication." (Dkt. No. 77-2, p. 43 of 50, '351 patent, col. 17:62 - col. 18:1). The '351 patent also refers to such a call as an "out-of-band interaction." (*Id.*, p. 42 of 50, '351 patent, col. 16:62-63). These passages suggest that the '351 patent uses the terms "communication," "experience," and "interaction" interchangeably to describe "out-of-band." Both experts agreed that the '351 patent uses the words "interaction" and "communication" interchangeably. (Dkt. No. 85-1, Islam Deposition Transcript 258:6-22 ("I

[2]The parties agree the "bid-directional" is a typographical error, and should be read as "bi-directional."

think I probably read past that, meaning I didn't make a distinction there."); *Id.* at 24:21 – 25:6; and Dkt. No. 85-2, Heppe Deposition Transcript 48:13-21). Accordingly, the Court looks to all such passages in the '351 patent in its effort to ascertain a meaning for the claim terms.

2. The Use of "In-Band" and "Out-of-Band" in the Specification

In addition to the specific teachings of the '351 patent discussed above, as an aid in the Court's effort to construe and distinguish "in-band communication" and "out-of-band communication," the Court reviewed all of the passages in the '351 patent that mention "out-of-band." These passages refer to "out-of-band" in a variety of different ways, including: (i) high bandwidth interactions (Dkt. No. 77-2, p. 43 of 50, '351 patent, col. 17:7-12), (ii) high speed data connection to provide real time video (*Id.*, p. 42 of 50, '351 patent, col. 16:57-61), (iii) users interacting with the system shown by arrows 268A and 268B in Figure 13 above (*Id.*, p. 42 of 50, '351 patent, col. 16:50-56), and (iv) cellular telephone calls with a personal trainer (*Id.*, p. 42 of 50, '351 patent, col. 16:62-63; *Id.*, p. 43 of 50, '351 patent, col. 17:42-46, col. 17:66 – col. 18:1).

a) In-Band and Out-of-Band Can Have the Same Data Rate

The specification of the '351 patent also teaches that both "in-band communication" and "out-of-band communication" can be high speed communications. ("out-of-band experiences [276A-276N shown Figure 13] can be high speed data connections to the local mobile computer." (Dkt. No. 77-2, p. 43 of 50, '351 patent, col. 17:43-46); "in-band" communications can be high speed communications with the exercise apparatus controller. (*Id.*, col. 17:16-18; Dkt. No. 77-2, p. 46 of 50, '351 patent, col. 24:15-22). Thus, the specification does not provide a basis for distinguishing "in-band communication" and "out-of-band communication" on the basis of data rate. (*See, e.g.*, February 27, 2015 Hearing Transcript, pp. 88:20 – 89:9; *See also*, Dkt. No. 85-3, ¶¶ 81-82, 85-87).

b) In-Band and Out-of-Band Can Have the Same Content

The specification of the '351 patent teaches that both "in-band communication" and "out-of-band-communication" can have the same content. As an example, the '351 patent states

> streaming video and/or audio, video files, audio files, graphics, etc. can be provided to the user and/or the trainer through an in-band or out of band communications link.

(Dkt. No. 77-2, p. 43 of 50, '351 patent, col. 18:1-4).

The '351 patent specification therefore does not provide a basis for distinguishing "in-band communication" and "out-of-band communication" on the basis of content. (*See, e.g.*, February 27, 2015 Hearing Transcript, p. 89:10-15; *See also*, Dkt. No. 85-3, ¶¶ 90-91).

c) In-Band and Out-of-Band Can Have the Same Frequency

The specification of the '351 patent does not distinguish "in-band communication" and "out-of-band communication" on the basis of frequency. (*See, e.g.*, February 27, 2015 Hearing Transcript, p. 88:20-25; *See also*, Dkt. No. 85-3, ¶¶ 92-94). Thus, the specification does not provide a basis for distinguishing "in-band communication" and "out-of-band communication" on the basis of frequency. (*See, e.g.*, February 27, 2015 Hearing Transcript, p. 88:20-25).

d) In-Band and Out-of-Band Can Use the Same Protocol and Channel, Such as a Bi-Directional Protocol on a Wireless Channel

The claims of the '351 patent specify an in-band communication using a bi-directional wireless protocol. (See e.g., Dkt 77-2, pp. 49-50 of 50, '351 patent, col. 30:42-43; col 31:4-5). The specification of the '351 patent teaches that "out-of-band communication" can also be wireless (February 27, 2015 Hearing Transcript, p. 87:22-25, p. 88:3-7; Dkt. No. 85-3, ¶¶ 83-84), and can employ a bi-directional protocol. (February 27, 2015 Hearing Transcript, p. 88:3-7). Thus, the specification does not provide a basis for distinguishing "in-band communication" and

"out-of-band communication" on the basis of protocol or channel. (*See*, *e.g.*, February 27, 2015 Hearing Transcript, pp. 88:13-19, pp. 88:20 – 89:20; pp. 104:25 – 105:7).

e) In-Band and Out-of-Band Can Have the Same Connectivity

The discussion of Figure 14 shows that both "in-band communication" and "out-of-band communication" can have the same connectivity – between the exercise device controller 280 and a local server 266A. (*See*, *e.g.*, February 27, 2015 Hearing Transcript, pp. 86:16 – 87:21; *See also*, Dkt. No. 85-3, ¶¶ 79-80, 88-89). Communications with a user can be "in-band communication" and can be "out-of-band communication." (Dkt. No. 77-2, p. 43 of 50, '351 patent, col. 17:34-42). Thus, the specification does not provide a basis for distinguishing "in-band communication" and "out-of-band communication" on the basis of connectivity. (*See*, *e.g.*, February 27, 2015 Hearing Transcript, pp. 86:16 – 87:21, p. 88:3-7, 13-19; p. 104:21-24).

f) In-Band Can Be Out-of-Band

The specification of the '351 patent teaches that "out-of-band interaction can also be performed in-band." (Dkt. No. 77-2, p. 42 of 50, '351 patent, col. 16:64-65; *See also*, *Id.*, p. 43 of 50, '351 patent, col. 17:16-18; and *Id.*, p. 46 of 50, '351 patent, col. 24:18-22). The specification therefore does not provide a basis for distinguishing "in-band communication" and "out-of-band communication" on the basis of connectivity, protocol (e.g., bidirectional), (e.g., wireless), information content, or as being with a user.

The '351 patent specification does not provide one skilled in the art with any clear teaching of how to distinguish between in-band versus out of band. (February 27, 2015 Hearing Transcript, pp. 88:20 - 89:20).

3. The Use of "In-Band" and "Out-of-Band" in the Prosecution History

During prosecution of the application that led to the '351 patent, the applicants argued that the prior art cited by the Examiner, Watterson '060, did not anticipate the amended claims. The applicants stated.

> One of the aspects of an embodiment of Applicant is the use of in-band communication in conjunction with out-of-band communication in an exercise system. See, for example, Applicant's Fig. 13 and accompanying description on page 28, lines 19-29. Watterson '060 does not hint of such a combination. Another aspect is the wireless communication between an exercise device with an exercise device ID. Again, there is no disclosure of such a combination with Watterson '060. Applicant therefore respectfully requests that the rejections based upon Watterson '060 be withdrawn.
>
> (Dkt. No. 77-4, p. 9 of 10)

This passage discussion of the use of "in-band communication" in conjunction with "out-of-band communication" suggests that the applicants considered the terms to be different. (February 27, 2015 Hearing Transcript, p. 80:1-16). Other than asserting the use of "in-band communication" in conjunction with "out-of-band communication," the statement does not aid one skilled in the art in discerning a difference between the two terms. *Id.*

Pursuant to 35 U.S.C. § 282 issued U.S. patents have a presumption of validity, including the presumption that patent Examiners performed their job correctly. Looking at the claim amendments offered by the patent applicants, one skilled in the art would assume that the applicants had added the use of in-band communication in conjunction with out-of-band communication to distinguish over the prior art. (February 27, 2015 Hearing Transcript, p. 92:7-18). Based on one skilled in art's general knowledge and the intrinsic record summarized above, one skilled in the art would not understand how to distinguish in band versus out-of-band, and

thus one skilled in the art would not understand how the amendment distinguishes over the prior art. (*Id.* at p. 92:19-22). In addition, as noted more fully below, one skilled in the art would understand that the terms "in-band communication" and "out-of-band communication" are relative terms. (*See, e.g.*, February 27, 2015 Hearing Transcript, pp. 91:13 – 92:6). Without a reference, one skilled in the art would not be able to understand what comprises an "in-band communication" or and "out-of-band communication" or how the applicants intended to distinguish over the prior art. (*Id.*). The evidence of one skilled in the art looking at the prosecution history in view of the '351 patent shows that the presumption does not help in this case.

4. The Use of "In-Band" and "Out-of-Band" in the Claims

Polar's expert, Dr. Heppe, testified that "looking at the words of the claim, nothing in this claim defines what is in or out, what is in-band communication or out-of-band communication." (February 27, 2015 Hearing Transcript, pp. 84:17 – 85:2; 85:14 – 86:-15, *See also*, Dkt. No. 85-3, ¶¶ 56-68). Claim 1, in addition to reciting the term "in-band communication," also recites that "in-band communication" (i) occurs between and exercise device and a local server (i.e., the connectivity or participants to the communication); (ii) is bi-directional; and (iii) is wireless. (*See also* February 27, 2015 Hearing Transcript, p. 86:19-24).

Claim 5 recites an exercise system, and, in pertinent part reads

> at least one exercise apparatus having an in-band bi-directional wireless communication device

The in-band communication device recited by claim 5 shares two features with the "in-band communication" of claim 1: it is bi-directional and it is wireless. The plain language of claim 5 does not recite what the "in-band bi-directional wireless communication device" is connected to, and it does not recite with whom or with what the claimed "in-band bi-directional wireless

communication device" communicates. (Dkt. No. 77-2, p. 50 of 50, '351 patent, col. 31:4-10). Thus, claim 5 does not recite the "connectivity" recited by claim 1 for the "in-band communication."

ICON's expert, Dr. Islam testified that the claims clearly define "in-band" via claimed connectivity, that it is bi-directional, and that is wireless, "no matter what you call it that is very well defined and is clearly understood by one of ordinary skill in the art." (February 27, 2015 Hearing Transcript, p. 49:15 – 50:-14; *See also*, p. 33:2-10; p. 38:6 - 39:6, p. 39:7-23; p. 41:20 – 42:7).[3] The language of claim 5, unlike claim 1, does not recite the connectivity of the recited "in-band bi-directional wireless communication device," i.e., what it is connected to or with whom or with what it communicates. Thus, the plain language of claim 5 does not define "in-band" by reciting a connectivity, which is one of the elements ICON's expert proposed to use to define "in-band communication." This difference is notable "because claim terms must be interpreted consistently." *Southwall Technologies, Inc. v. Cardinal IG Company*, 54 F.3d 1570, 1579 (Fed. Cir. 1995). The interpretation of "in-band" based on connectivity, bi-directional, and wireless, does not apply to the plain language of claim 5.

In view of the testimony and the intrinsic record, the language of the claims is not helpful in understanding and distinguishing "in-band communication" and "out-of-band communication. (February 27, 2015 Hearing Transcript, pp. 84:17 – 85:2. 85:14 – 86:15; *See also*, Dkt. No. 85-3, ¶¶ 56-68).

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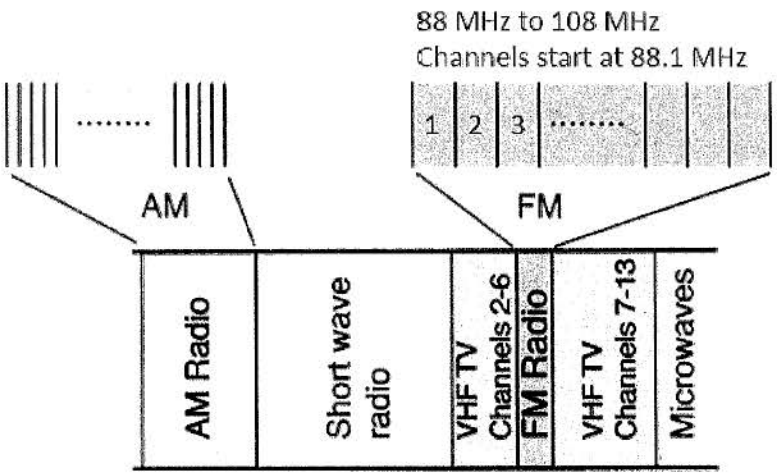
[3]ICON also asserts that "in-band communication is communication to or from the exercise apparatus." (February 27, 2015 Hearing Transcript, p. 33:20-25). And, ICON asserts that "out-of-band communication" is any communication other than in-band communication. (*Id.*, p. 34:1-6). ICON's expert testified that with these definitions, once in-band is defined, then out-of-band is communication other than that. (*Id.*, p. 40:9-11). He also testified, however, that it is not correct that anything other than in-band communication is out-of band communication. (*Id.*, p. 35:6-36:2). As discussed with respect to Figure 14, *supra*, the '351 patent specification shows that both "in-band communication" and "out-of-band communications" can be to or from the exercise apparatus. These proposed definitions therefore do not square with the teachings of the '351 patent and do not help distinguish "in-band communication" from "out-of-band communication."

5. "In-Band" and "Out-of-Band" Are Relative Terms

The modifiers "in-band" or "out-of-band" appear in each of the claim terms: "in-band communication," "out-of-band communication," and "out-of-band communication device." The fundamental nature of these terms "is that 'in-band' and 'out-of-band' are relative terms that require a reference." (February 27, 2015 Hearing Transcript, pp. 75:12 – 76:1; 82:8-15).

The Court considered whether and how the terms "in-band communication" and "out-of-band communication" may relate to frequency bands. The following illustrates a portion of a radio band that includes the AM radio band in pink and the FM radio band in blue. (*Id.*, p. 74:14-17). The AM band and the FM band are referred to as frequency bands. *Id.* The term "band" is a general and does not by itself define its boundaries. (*Id.*, p. 74:17-19, p. 75:1-3). In the following figure, the FM radio band is broken down into channels numbered as 1, 2, and 3, which can each be referred to as a band, or a sub-band. (*Id.*, p. 74:20-25). If a person was listening to channel 1, that channel could be considered "in-band" and the other channels would be considered "out-of-band." (*Id.*, p. 75:3-9). If the user switched to channel 2, then that channel would be "in-band," and channel 1 would be "out-of-band." (*Id.*, p. 75:9-12).



This example illustrates that "in-band" and "out-of-band" have a general meaning to those skilled in the art, and that the terms are treated as distinct and separate. (February 27, 2015 Hearing Transcript, p. 75:9-16). It also illustrates that "in-band" and "out-of-band" are relative terms. (*Id.*, pp. 75:16 – 76:1). Depending upon the reference chosen, different things can be "in-band" and out-of-band," as the two channels are in this example. (*Id.*, p. 77:13-15).

The terms "in-band" and "out-of-band" are not limited to frequency bands, and can be, e.g., different time slots within a stream of data. (February 27, 2015 Hearing Transcript, pp. 76:2 – 77:15; pp. 82:16 – 83:1; *See also*, Dkt. No. 85-3, Dr. Heppe Declaration, ¶¶ 62-64). Another use of the terms "in-band" and "out-of-band" can be to refer to communications between two computers, A and B. Depending upon the reference, communications from computer A could be "in-band," and communications from computer B could be "out-of-band," depending upon the reference selected as with the two channels in the example above. (February 27, 2015 Hearing Transcript, pp. 77:16 – 78:8).

The extrinsic evidence noted by the experts shows the use of a reference when using the terms "in-band" and "out-of-band" to distinguish the two terms. (February 27, 2015 Hearing Transcript, p. 78:10-24). In U.S. Patent No. 6,473,795, in-band refers to signals sent from the network management software in a synchronous wire, while out-of-band refers to signals sent via an asynchronous port. The reference chosen in this patent was the type of communication channel. (*Id.*, pp. 79:15 – 80:4). U.S. Patent No. 6,510,481 differentiates in-band from out-of-band by different periods of time and different protocols. (*Id.*, p. 80:5-18). U.S. Patent No. 5,257,396, U.S. Patent No. 5,497,187, and U.S. Patent No. 6,721,547 each differentiate in-band and out-of-band based on frequency bands. (*Id.*, pp. 80:19 – 81:7).

Similarly, William Stallings, "Data & Computer Communications," Sixth Edition

(Prentice Hall, Upper Saddle River, New Jersey, 2000) ISBN 0-13-084370-9, differentiates in-band from out-of-band based on frequency. (February 27, 2015 Hearing Transcript, p. 81:8-14). The textbook Larry L. Peterson & Bruce S. Davie, "Computer Networks: A Systems Approach," (Morgan Kaufmann Publishers, San Francisco, California, 1996), ISBN 1-55860-368-9, uses different logical data flows to distinguish in-band data from out-of-band data, and defines out-of-band as separate from the normal data flow. (*Id.*, p. 81:15-22). Both S. Keshav, "An Engineering Approach to Computer Networking," (Addison-Wesley, Reading, Massachusetts, 1997), ISBN 0-201-63442-2, and "The CRC Handbook of Modern Telecommunications," Editors-in-Chief Patricia Morreale and Kornel Terplan, (CRC Press, 2001), ISBN 0-8493-3337-7, use different channels to differentiate between in-band and out-of-band. *Id.*, p. 81:23-24). Lastly, the textbook Paul E. Green, "Fiber Optic Networks," (Prentice Hall, Englewood Cliffs, New Jersey, 1993), ISBN 0-13-319492-2, differentiates in-band and out-of-band based on wavelength, time slots, or CDMA codes. (*Id.*, pp. 81:24-82:1).[4]

Each of the ten extrinsic prior art patents and text books cited by the experts defines a reference that allows the reader to differentiate in-band from out-of-band in relation to that reference. (February 27, 2015 Hearing Transcript, p. 82:8-15). The testimony together with the extrinsic patents and textbooks, show that those skilled in the art understand that the terms "in-band" and "out-of-band" are relative terms, and only have meaning in a given context with a defined reference, such as a frequency, a channel, a protocol, time slots, and data streams. (*See, e.g.*, *id.*, pp. 82:8 – 83:2).

The language of the claims does not provide a reference for "in-band" and "out-of-band." (February 27, 2015 Hearing Transcript, pp. 85:14 – 86:5; p. 89:21-25; pp. 90:22 – 91:8). The

[4]While Plaintiff objects to these extrinsic evidence citations (CM/ECF No. 110, at 5), the same are referred to by Plaintiff in Plaintiff's expert report (CM/ECF No. 87-1, at 18-28).

applicants did not define a reference band or equivalent in the prosecution history remarks discussed above. (*See, e.g., id.*, p. 90:1-21). Thus, one of ordinary skill in the art cannot determine with reasonable certainty what an in-band communication is or what an out-of-band communication is, because these terms require a reference and no reference is described or can be defined that is consistent throughout the intrinsic evidence for the '351 patent. (*Id.*, pp. 90:22 – 91:8). The terms are therefore ambiguous because they are not defined with reasonable certainty for one skilled in the art. *Nautilus*, 134 S.Ct. at 2129. Thus, the claims are invalid because they fails to define the invention with reasonable certainty for those skilled in the art. *Id.* at 2124.

B. The Claimed Relationship Between "In-Band Communication and "Out-of-Band Communication"

The claimed relationship between in-band communication and out-of-band communication appears in claim 1 and claim 5 as follows.

Claim 1	Claim 5
an out-of-band communication with a user of said at least one exercise apparatus, wherein said ***out-of-band communication has a relationship to said in-band communication***	an ***out-of-band communication*** device capable of a communication with a user of said at least one exercise apparatus ***that has a relationship to said in-band communication***

The term "relationship" does not appear in the '351 patent prior to the claims. (February 27, 2015 Hearing Transcript, p. 86:11-14; *See also*, Dkt. No. 98, p. 10 of 22, n. 4). In ordinary English, it is a very broad term that may mean an association between two things or events, and can encompass a number of different kinds of relationships, such as a physical relationship, a connection relationship, a conceptual relationship, a familial relationship, and a causal relationship. (Dkt. No. 84-1, Heppe Deposition Transcript 59:8 - 60:9, 60:10 – 61:15; *See also*, Dkt. No. 84-2, Heppe Declaration, ¶¶ 67, 110, Dkt. No. 84-2, Heppe Declaration, p. 7 of 8, ¶ k). The meaning of the word "relationship" is not, by itself, contested. It is the claimed

"relationship" between the "in-band communication" and "out-of-band" communication that the Court addresses, and whether the '351 patent defines the claimed "relationship" with reasonable certainty for one skilled in the art.

The out-of-band communication of claim 1, shown in the above table, does not require any structure for the out-of-band communication, and the language does not exclude verbal conversations. (February 27, 2015 Hearing Transcript, p. 93:17-19). For example, the plain language covers a user's conversations with, for example, a personal trainer, who may be coaching the user. (*Id.*, p. 93:19 – p. 94:6; *See also*, Dkt. No. 85-3, Heppe Declaration, ¶ 65). Similarly, if the personal trainer were using a cell phone, the communication would be a true out-of-band communication and fall within both claim 1 and claim 5. (February 27, 2015 Hearing Transcript, p. 94:7-22; *See also*, Dkt. No. 85-3, Heppe Declaration, ¶¶ 83-84).

The language of the claims does not place a temporal limitation on the out-of-band communication; it could be before, during, or after exercising. (February 27, 2015 Hearing Transcript, p. 95:3-25). The out-band-communication could be a conversation, verbal or by cell phone with the user's spouse about the exercise device and whether to buy it. (*Id.*, p. 95:3-25; *See also*, Dkt. No. 85-3, Heppe Declaration, ¶ 66). The out-of-band communication could be after the purchase, such as an email from the manufacturer asking about the user's exercise habits. (February 27, 2015 Hearing Transcript, p. 96:6-17). The "out-of-band communication" claim 1 could also be a conversation with a nearby fellow exerciser about the exercise, such as how many calories the user has burned. (*Id.*, p. 96:17-25).

There is no basis in the claim or the specification to include or exclude such communications from the scope of the claimed relationship. One skilled in the art has no way to navigate the possibilities. (February 27, 2015 Hearing Transcript, p. 97:2-8, *See also*, *id.*, p.

93:2-8, p. 94:2-6, p. 94:22 – 95:2, p. 95:23 – p. 96:5; *See also*, Dkt. No. 84-2, Heppe Declaration, ¶¶ 111-112, Heppe Declaration, p. 7 of 8, ¶ k). There is no guidance of what comprises the "out-of-band communication" having a relationship to the "in-band communication." (February 27, 2015 Hearing Transcript, p. 94:22-24; pp. 95:3 – 96:5; pp. 96:6 – 97:25).

The claimed "relationship" term is therefore ambiguous because it is not defined with reasonable certainty for one skilled in the art. *Nautilus*, 134 S.Ct. at 2129. Thus, the claims are invalid because they fail to define the invention with reasonable certainty for those skilled in the art. *Id.* at 2124.

V. Conclusion

Having determined that the '351 patent's claim terms—specifically, "in-band," "out-of-band," and "relationship"—are ambiguous and incapable of construction, and having determined that the '351 patent's claims, "read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention," the court holds that the '351 is invalid for indefiniteness. *Nautilus*, 134 S.Ct. at 2124.

As such, the court orders that Plaintiff's claim against Defendants for infringement of the '351 patent is DISMISSED WITH PREJUDICE.

Let judgment be entered accordingly.

DATED this 18th day of May, 2015.

Bruce S. Jenkins
United States Senior District Judge

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF UTAH

ICON HEALTH & FITNESS, INC., a Delaware corporation, Plaintiff, v. **POLAR ELECTRO OY,** a Finnish company, **POLAR ELECTRO INC.,** a Delaware corporation, Defendants.	Civil Action No. 1:11-cv-00167-BSJ **ORDER GRANTING ICON HEALTH & FITNESS, INC.'S UNOPPOSED MOTION TO DIRECT ENTRY OF JUDGMENT ON ITS THIRD CLAIM FOR RELIEF** District Judge Bruce S. Jenkins

ICON Health & Fitness Inc.'s Unopposed Motion to Direct Entry of Judgment on Its Third Claim for Relief (Docket No. 115) ("Motion") came before the Court on July 6, 2015. After careful consideration of the Motion, the relevant controlling law, and Rule 54(b) of the Federal Rules of Civil Procedure, ICON's Motion is GRANTED.

BACKGROUND

In May 2015, this court issued a Memorandum & Order which determined that "the '351 patent claim terms . . . are ambiguous and incapable of construction" and held United States Patent No. 6,921,351 ("'351 Patent") invalid for indefiniteness. (Docket No. 111.) As such, the court ordered that "Plaintiff's claim against Defendant for infringement of the '351 patent is DISMISSED WITH PREJUDICE." (*Id.*) ICON filed this Motion to certify the Court's order as final to allow it to appeal.

DISCUSSION

In making determinations under Rule 54(b), a court should consider whether the judgment represents an ultimate disposition of an individual claim entered in the course of a multiple claims action.[1] The district court must go on to determine whether there is any just reason for delay.[2] Judicial administrative interests include "whether the claims under review [are] separable from the others remaining to be adjudicated" and "whether the nature of the claims already determined [is] such that no appellate court would have to decide the same issues more than once even if there were subsequent appeals."[3]

The claims addressed in the Memorandum and Order are distinct and separable from the remaining claims in this case. This separability was recognized earlier in this action in the decision to stay this case with respect to ICON's claims of infringement based on United States Patents Nos. 6,701, 271 and 7,789,800 while allowing the case to proceed with respect to the '351 Patent. (Docket No. 51.) Furthermore, entry of judgment now will not lead to successive appeals of the same issues. If this case involved more than two parties, and more than one of them were impacted by the Memorandum & Order, then there might be a risk of successive appeals because each affected party might be entitled to its own appeal. But here, whatever the reviewing court decides on ICON's appeal of the judgment now requested will be the law of the case both on remand and in any subsequent appeal. So, granting this motion will not lead to repetitive review of the same issues in successive appeals.

---

[1] *Curtiss-Wright Corp. v. General Elec. Co.*, 446 U.S. 1, 7 (1980) (quoting *Sears, Roebuck & Co. v. Mackey*, 351 U.S. 427, 436 (1956)).
[2] *Id.* at 8.
[3] *Id.* at 8 & n. 2.

Based on the foregoing, the Memorandum and Order is an ultimate disposition for purposes of Rule 54(b). On this basis, certification of the Memorandum and Order under Rule 54(b) is proper.

ORDER

IT IS HEREBY ORDERED that the clerk enter judgment in favor of defendants Polar Electro Oy and Polar Electro, Inc. with respect to ICON's claim for infringement of the '351 patent.

Dated this 8th day of July, 2015

BY THE COURT

Bruce S. Jenkins
U.S. District Judge

US006921351B1

(12) **United States Patent**
Hickman et al.

(10) **Patent No.: US 6,921,351 B1**
(45) **Date of Patent: Jul. 26, 2005**

(54) **METHOD AND APPARATUS FOR REMOTE INTERACTIVE EXERCISE AND HEALTH EQUIPMENT**

(75) Inventors: **Paul L. Hickman**, Los Altos Hills, CA (US); **Michael L. Gough**, Ben Lomond, CA (US)

(73) Assignee: **Cybergym, Inc.**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 547 days.

(21) Appl. No.: **10/045,619**

(22) Filed: **Oct. 19, 2001**

(51) **Int. Cl.**[7] **A63B 21/00**

(52) **U.S. Cl.** **482/8**; 482/4; 482/9; 482/901

(58) **Field of Search** 482/1–9, 51, 54, 482/57, 900–902; 600/300, 520, 418; 607/2, 19, 32

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Internet Archive Wayback Machine, archive for www.ifit.com, at http://web.archive.org/web/*/www.ifit.com, Sep. 1, 2003, 1 pg.
iFIT.com "Internet workouts control your treadmill, bike, or elliptical", at http://www.ifit.com, Sep. 1, 2003, 3 pgs.

* cited by examiner

Primary Examiner—Glenn E. Richmon

(57) **ABSTRACT**

An exercise system includes a local system having an exercise apparatus and an associated local computer, where the local computer controls and monitors the operation and use, respectively, of the exercise apparatus. The system further includes a remote system having a remote computer, and a transmission medium preferably including the Internet that couples the local system to the remote system for data communication between the local system and the remote system. The remote system may receive local system data from the local system concerning the use of the exercise apparatus, and the local system may receive remote system data from the remote system concerning the operation of the exercise apparatus. The local computer preferably controls the operation of the exercise apparatus based upon a modifiable script stored in a read/write memory of the local computer, which can be updated by the remote system. A method for controlling an exercise apparatus includes running a modifiable script on a local computer to control the use and to monitor the operation of an exercise apparatus, and communicating with a remote system, preferably via the Internet, to provide the remote system with data concerning the use of the exercise apparatus. The script is stored in read/write memory of the local computer and remote system data received from the remote system may include at least a portion of a new script to be stored in the read/write memory of the local computer.

20 Claims, 32 Drawing Sheets

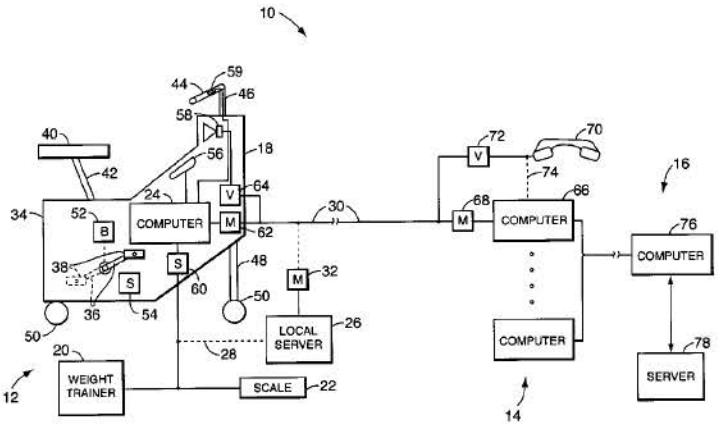
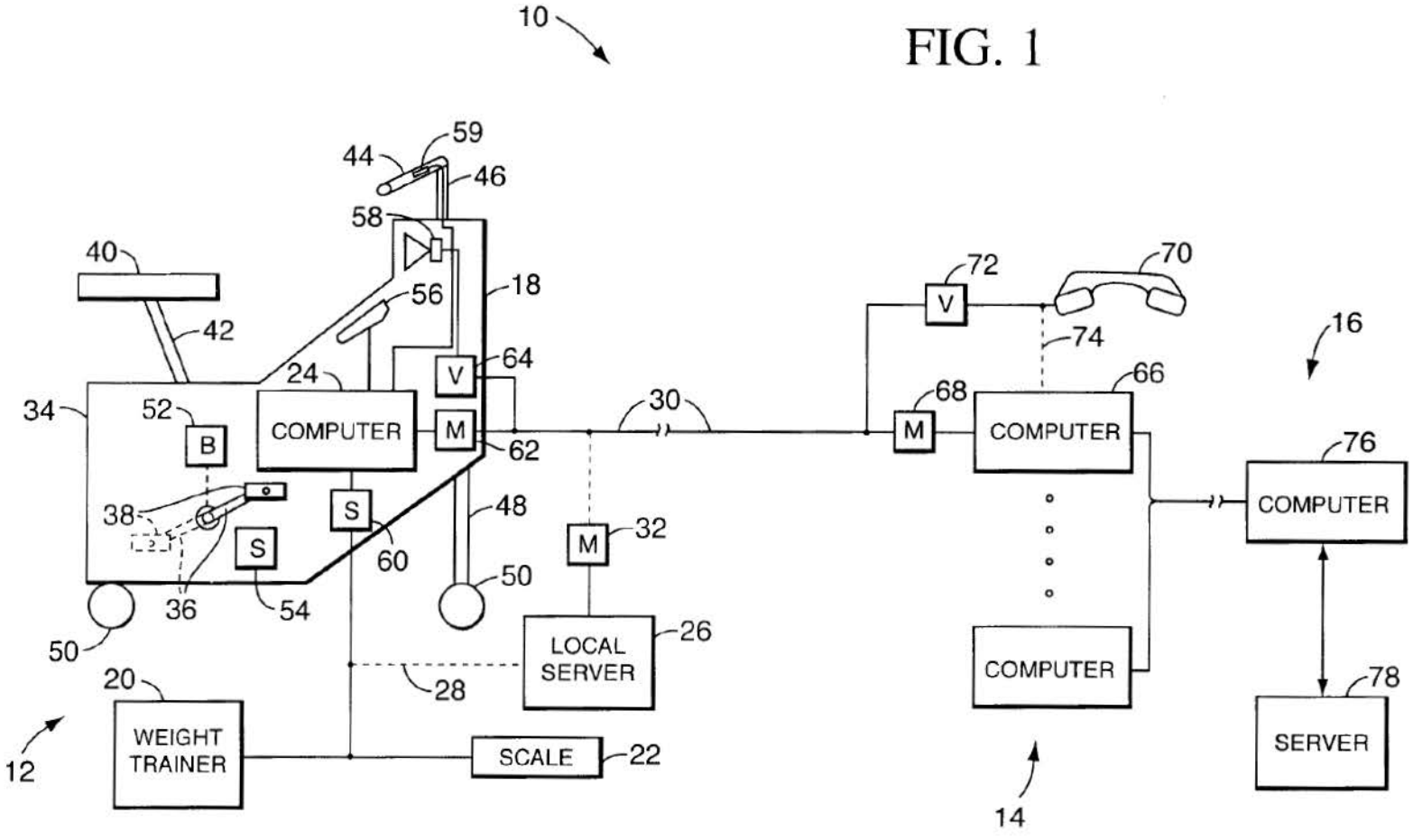


FIG. 1


10
59
44
46
58
40
56
18
72
70
42
V
74
16
64
24
66
34
52
30
68
B
COMPUTER
M
M
COMPUTER
62
76
38
S
48
M
32
COMPUTER
S
60
36
54
50
50
LOCAL SERVER
26
20
28
WEIGHT TRAINER
SCALE
22
78
SERVER
12
14

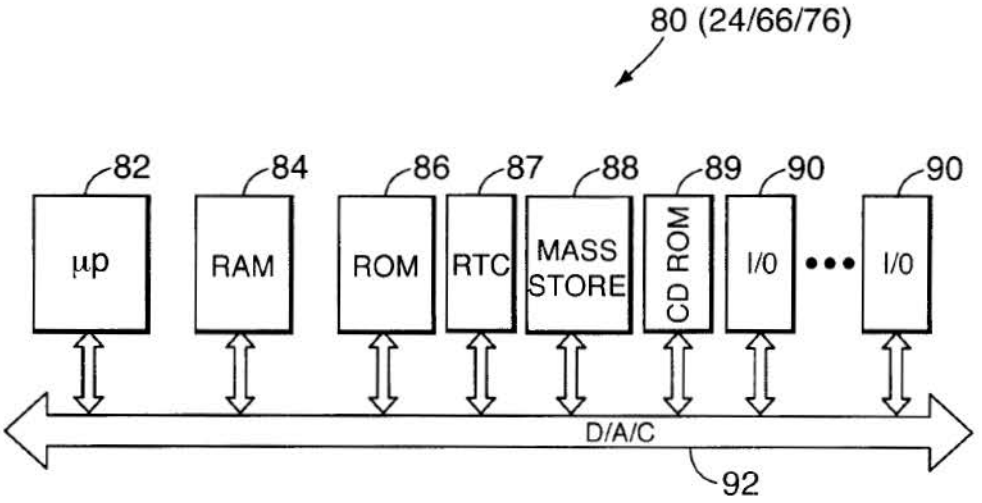

80 (24/66/76)
82
84
86
87
88
89
90
90
µp
RAM
ROM
RTC
MASS STORE
CD ROM
I/0
I/0
D/A/C
92

FIG. 2

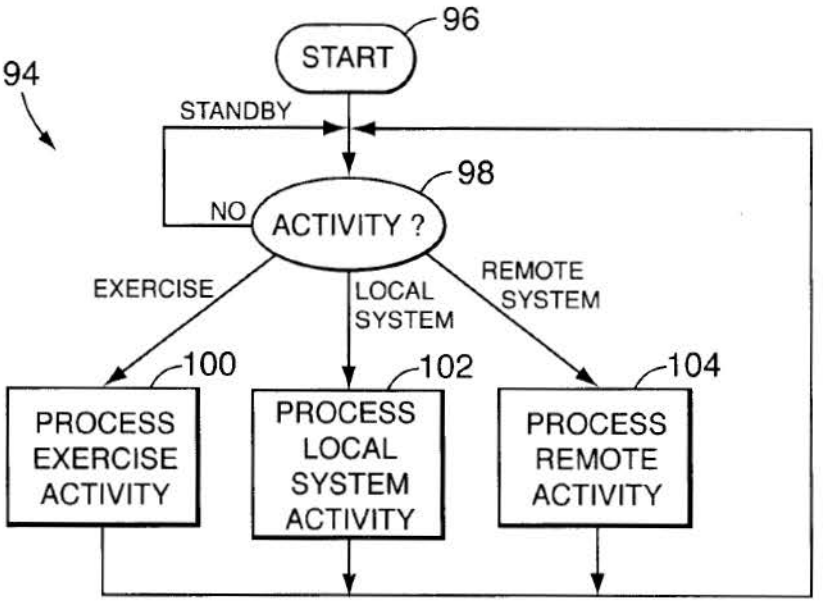

94
96
START
STANDBY
98
NO
ACTIVITY ?
EXERCISE
LOCAL SYSTEM
REMOTE SYSTEM
100
102
104
PROCESS EXERCISE ACTIVITY
PROCESS LOCAL SYSTEM ACTIVITY
PROCESS REMOTE ACTIVITY

FIG. 3

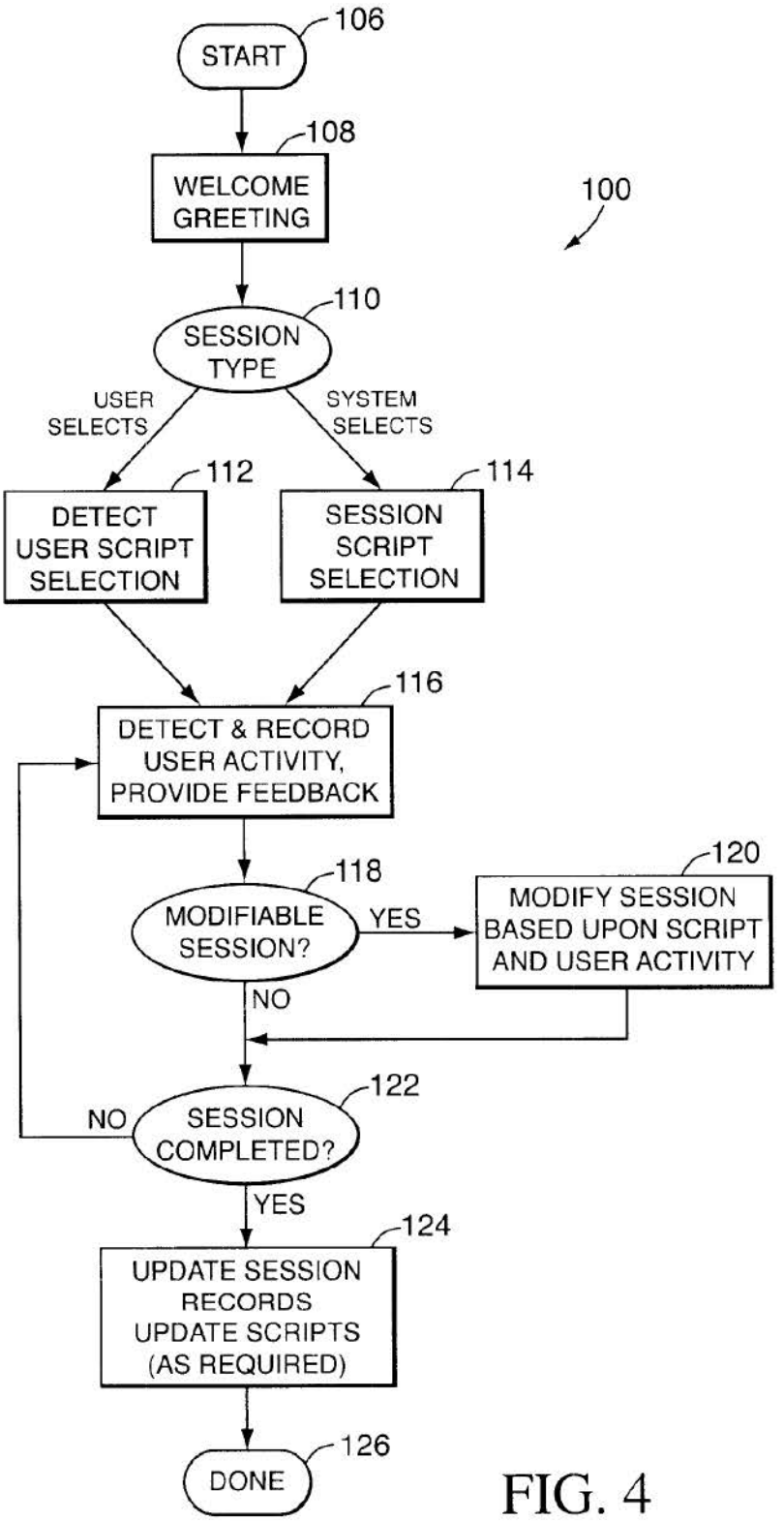

106
START
108
WELCOME GREETING
100
110
SESSION TYPE
USER SELECTS
SYSTEM SELECTS
112
DETECT USER SCRIPT SELECTION
114
SESSION SCRIPT SELECTION
116
DETECT & RECORD USER ACTIVITY, PROVIDE FEEDBACK
118
MODIFIABLE SESSION?
YES
120
MODIFY SESSION BASED UPON SCRIPT AND USER ACTIVITY
NO
122
NO
SESSION COMPLETED?
YES
124
UPDATE SESSION RECORDS UPDATE SCRIPTS (AS REQUIRED)
126
DONE

FIG. 4

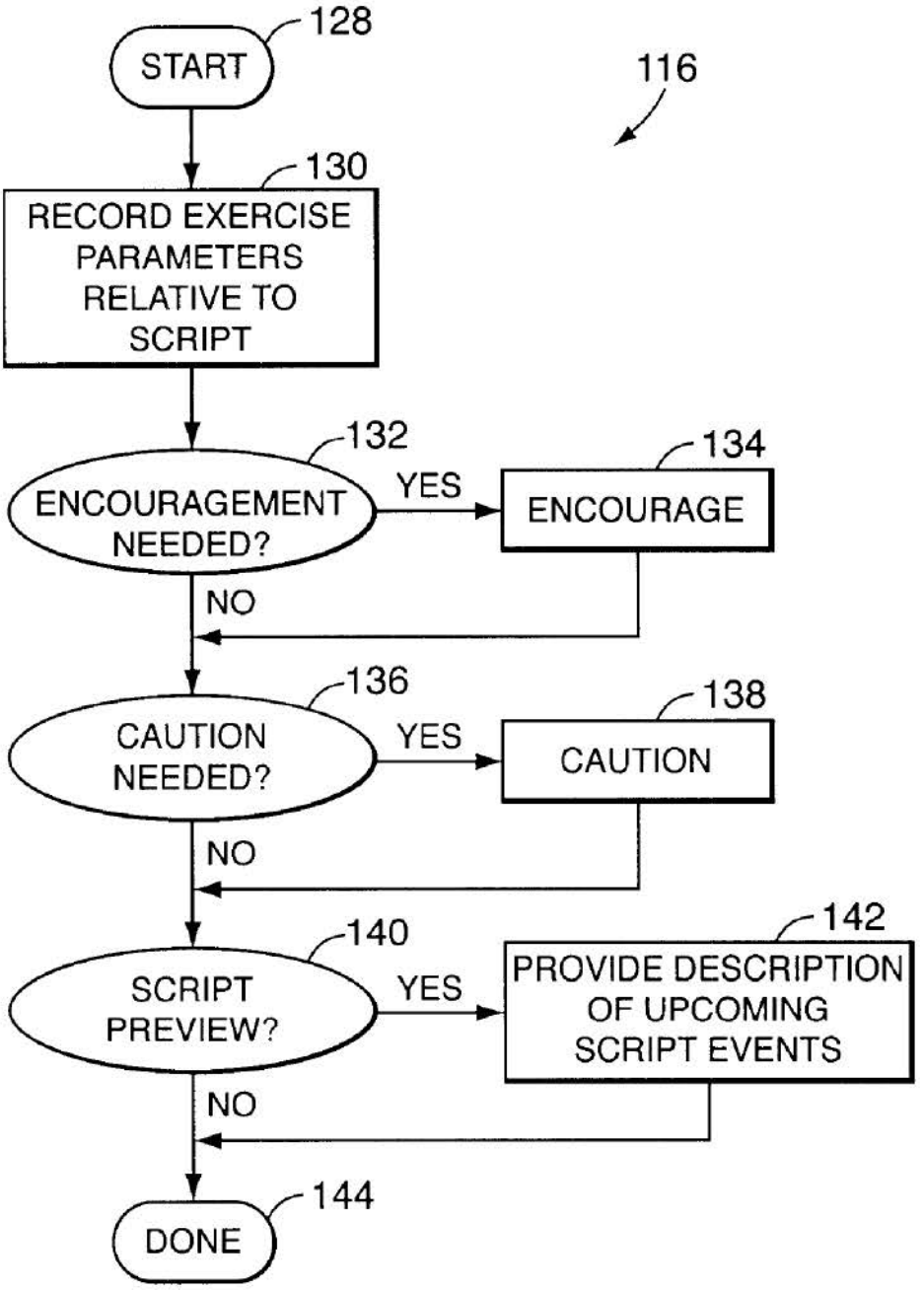
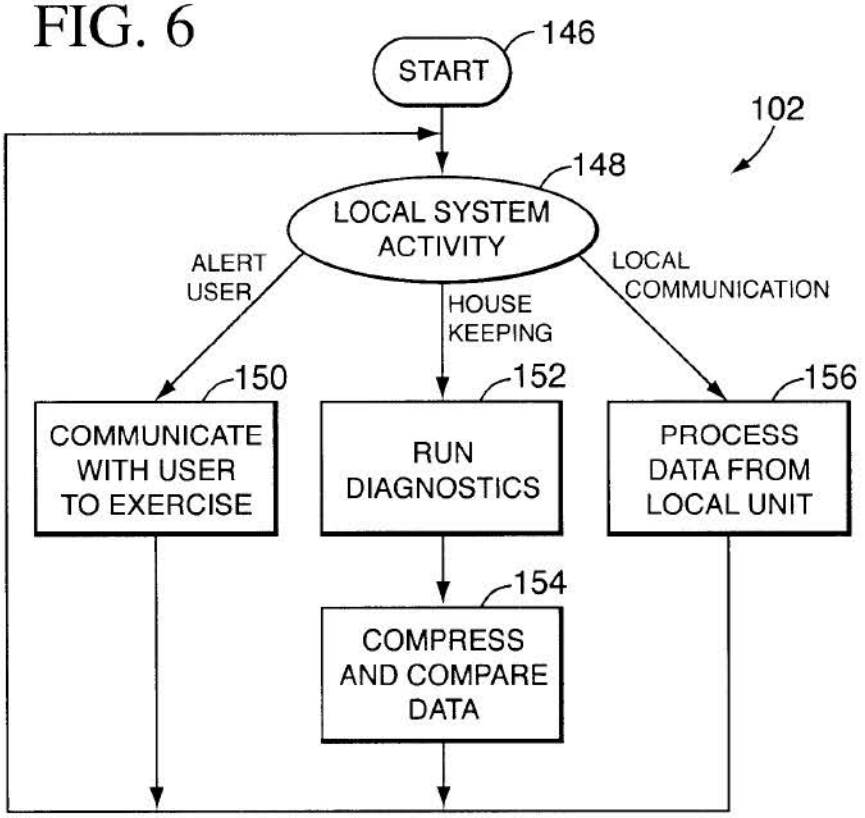

128
START
116
130
RECORD EXERCISE PARAMETERS RELATIVE TO SCRIPT
132
ENCOURAGEMENT NEEDED?
YES
134
ENCOURAGE
NO
136
CAUTION NEEDED?
YES
138
CAUTION
NO
140
SCRIPT PREVIEW?
YES
142
PROVIDE DESCRIPTION OF UPCOMING SCRIPT EVENTS
NO
144
DONE

FIG. 5

FIG. 6


146
START
102
148
LOCAL SYSTEM ACTIVITY
ALERT USER
HOUSE KEEPING
LOCAL COMMUNICATION
150
152
156
COMMUNICATE WITH USER TO EXERCISE
RUN DIAGNOSTICS
PROCESS DATA FROM LOCAL UNIT
154
COMPRESS AND COMPARE DATA

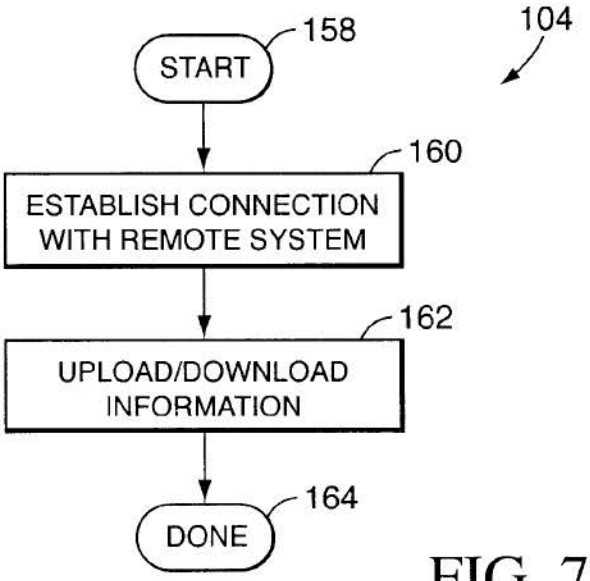

104
158
START
160
ESTABLISH CONNECTION WITH REMOTE SYSTEM
162
UPLOAD/DOWNLOAD INFORMATION
164
DONE

FIG. 7

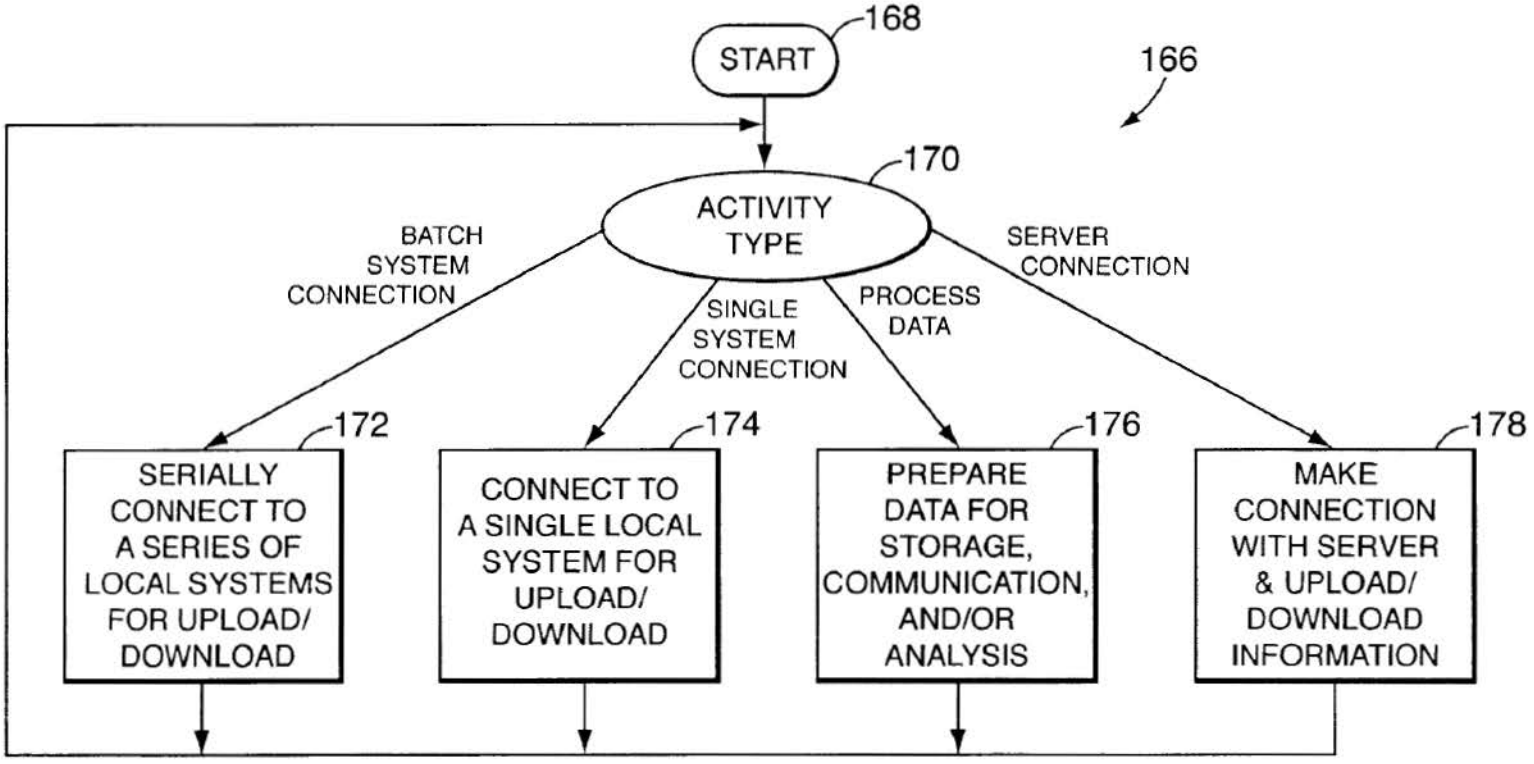

START
168
166
170
ACTIVITY TYPE
BATCH SYSTEM CONNECTION
SINGLE SYSTEM CONNECTION
PROCESS DATA
SERVER CONNECTION
172
174
176
178
SERIALLY CONNECT TO A SERIES OF LOCAL SYSTEMS FOR UPLOAD/ DOWNLOAD
CONNECT TO A SINGLE LOCAL SYSTEM FOR UPLOAD/ DOWNLOAD
PREPARE DATA FOR STORAGE, COMMUNICATION, AND/OR ANALYSIS
MAKE CONNECTION WITH SERVER & UPLOAD/ DOWNLOAD INFORMATION

FIG. 8

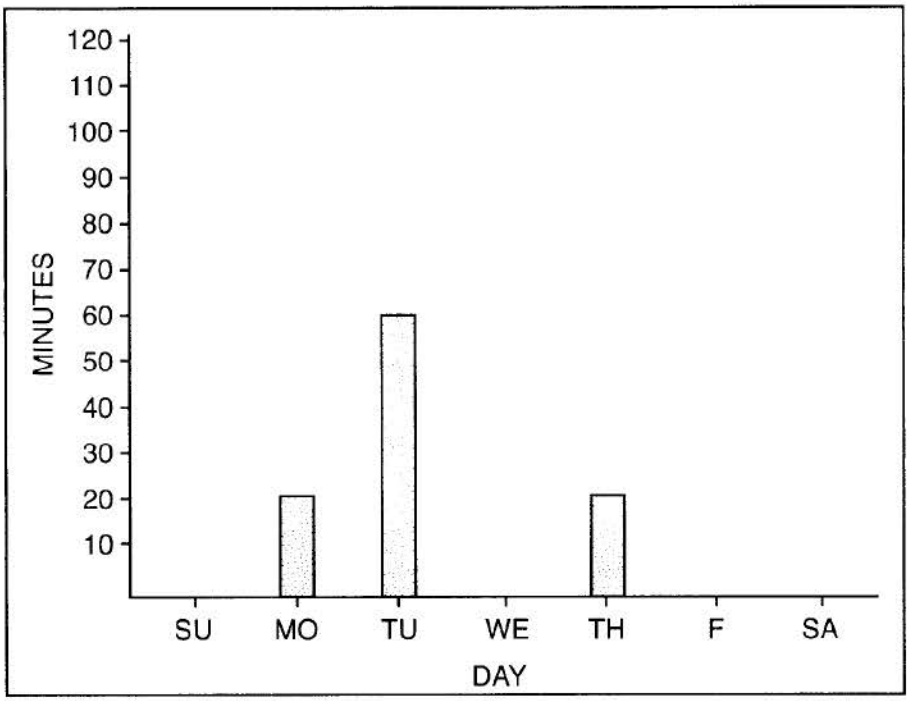


FIG. 8A

SUNDAY
- NO EXERCISE

MONDAY
- 10 MINUTES CYCLING
  - 232 CALORIES
  - 6 MINUTES AT 80% HEARTRATE
  - 1.8 MILES
  - DIFFICULTY 6
- 10 MINUTES WEIGHTS
  - 172 CALORIES
  - 20 REPS @ 100 LBS.
  - 20 REPS @ 80 LBS.

TUESDAY
ETC.

FIG. 8B

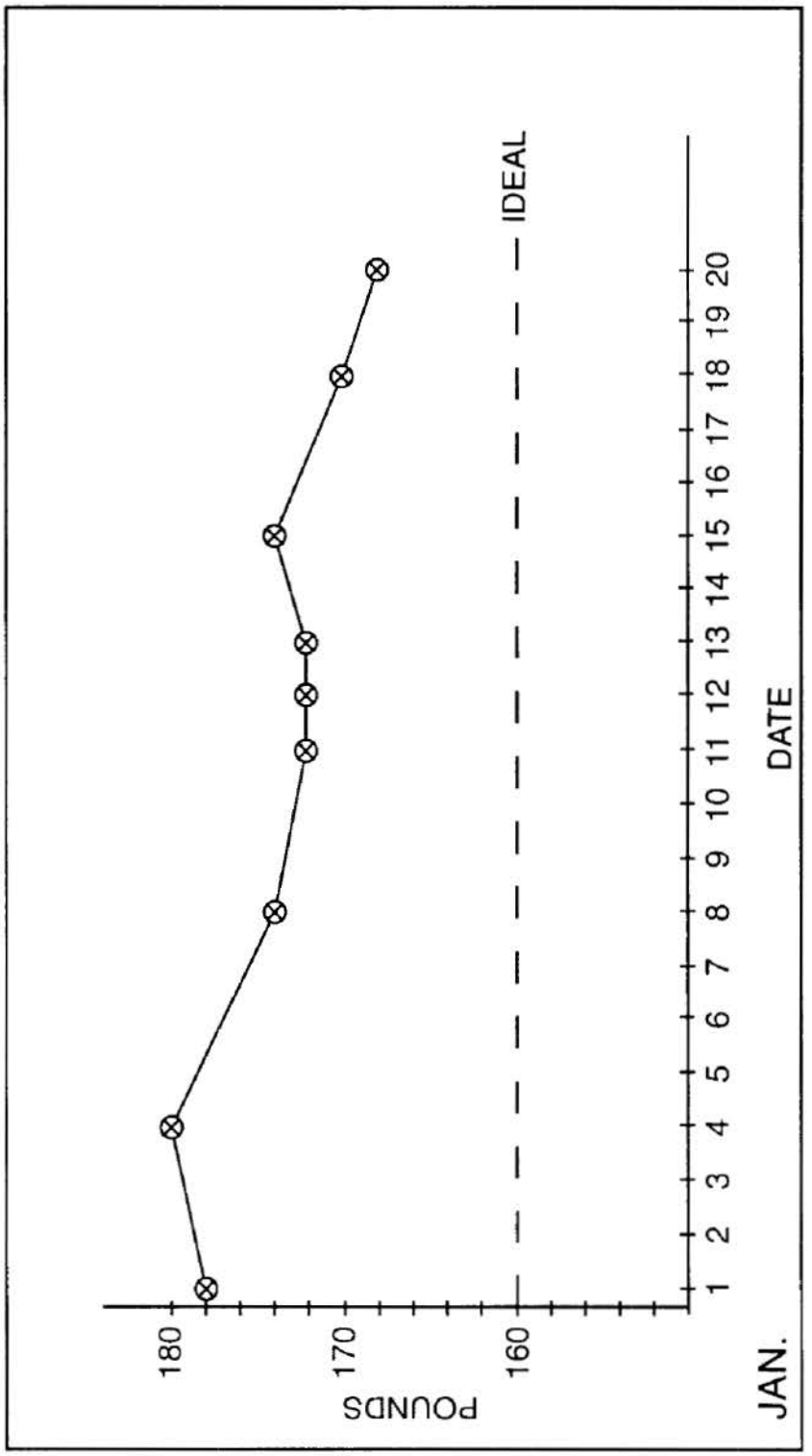

IDEAL
POUNDS
180
170
160
DATE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
JAN.

FIG. 8C

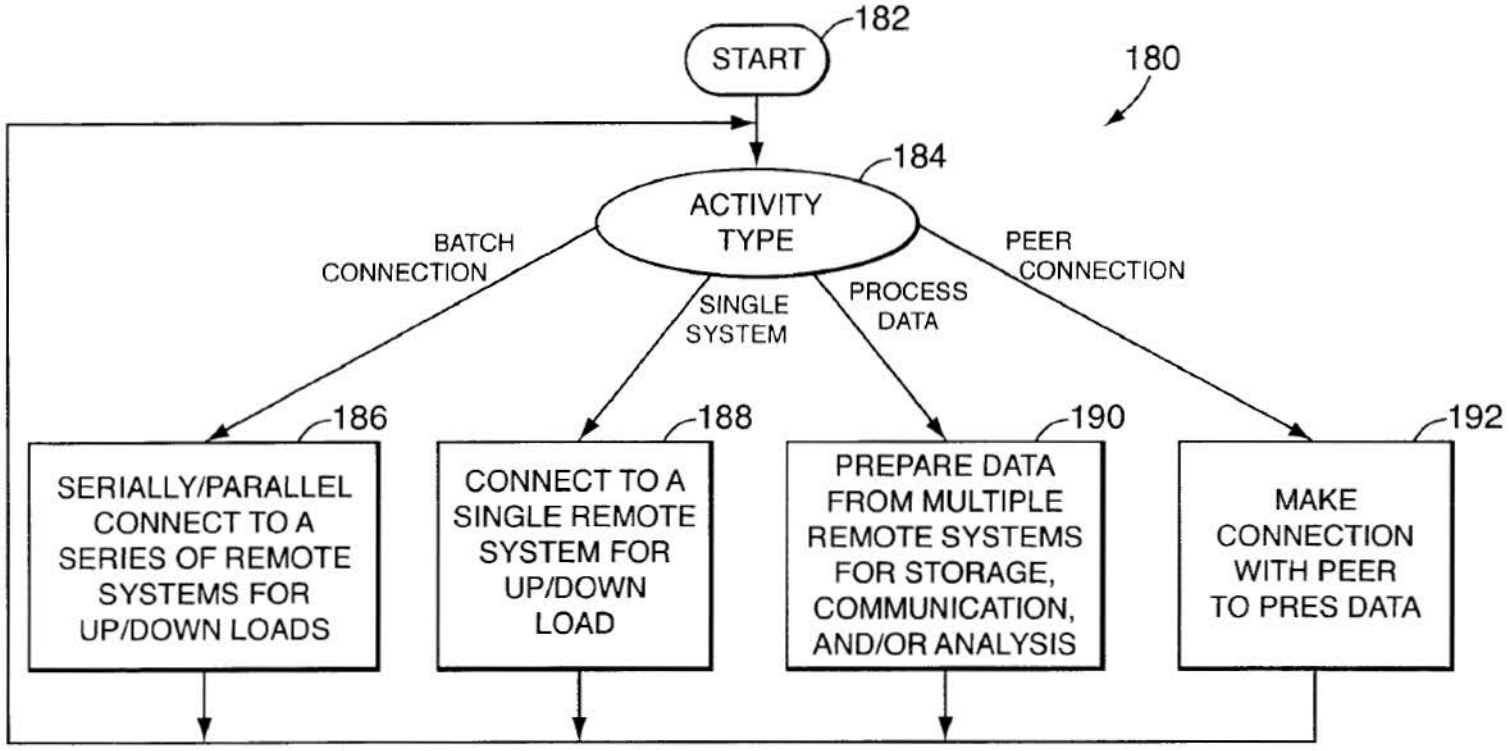

START
182
180
184
ACTIVITY TYPE
BATCH CONNECTION
SINGLE SYSTEM
PROCESS DATA
PEER CONNECTION
186
188
190
192
SERIALLY/PARALLEL CONNECT TO A SERIES OF REMOTE SYSTEMS FOR UP/DOWN LOADS
CONNECT TO A SINGLE REMOTE SYSTEM FOR UP/DOWN LOAD
PREPARE DATA FROM MULTIPLE REMOTE SYSTEMS FOR STORAGE, COMMUNICATION, AND/OR ANALYSIS
MAKE CONNECTION WITH PEER TO PRES DATA

FIG. 9

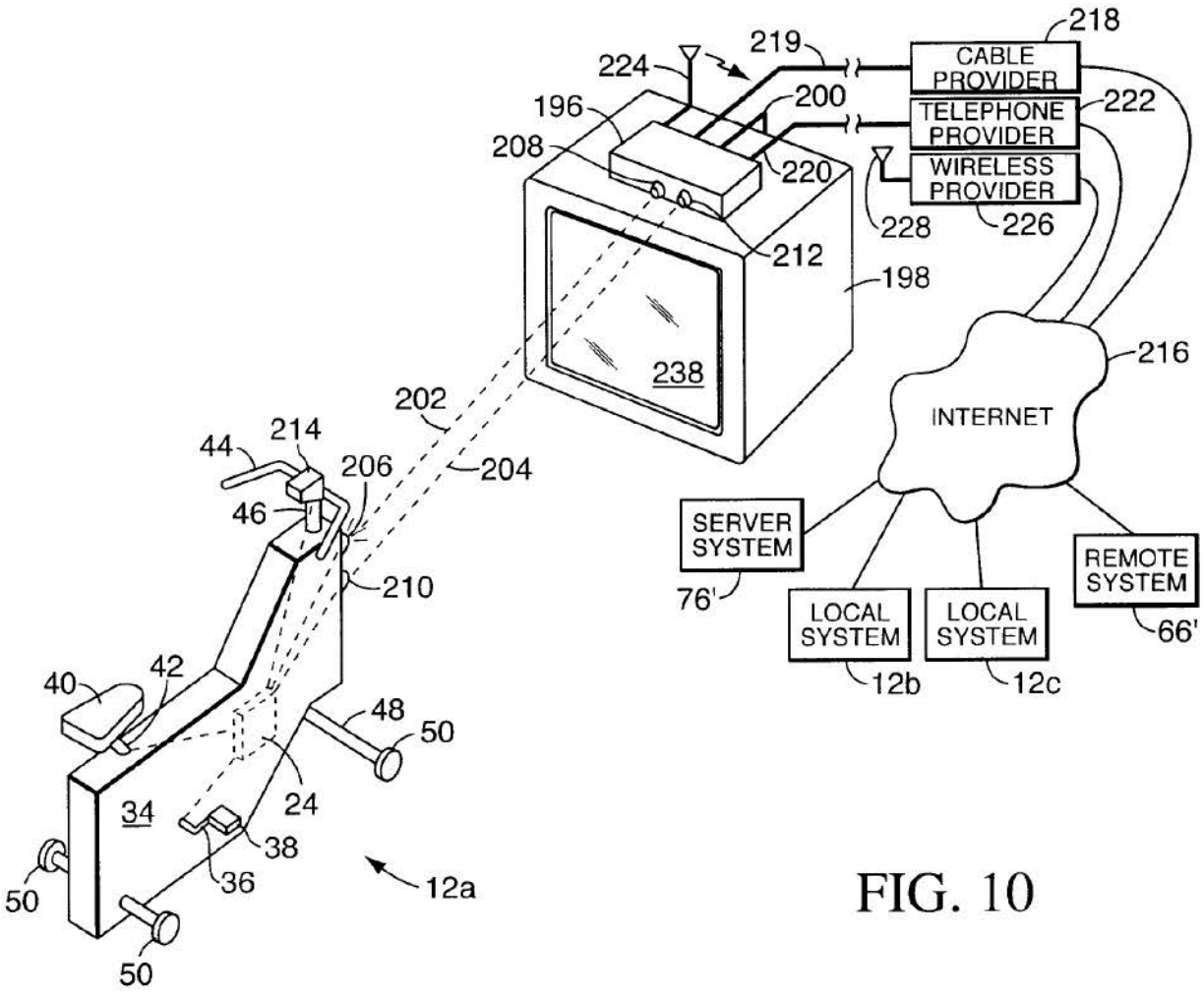

218
219
224
CABLE PROVIDER
200
196
TELEPHONE PROVIDER
222
208
220
WIRELESS PROVIDER
228
226
212
198
238
216
INTERNET
202
214
44
206
204
46
SERVER SYSTEM
76'
REMOTE SYSTEM
66'
LOCAL SYSTEM
LOCAL SYSTEM
12b
12c
210
40
42
48
50
34
24
38
36
12a
50
50

FIG. 10

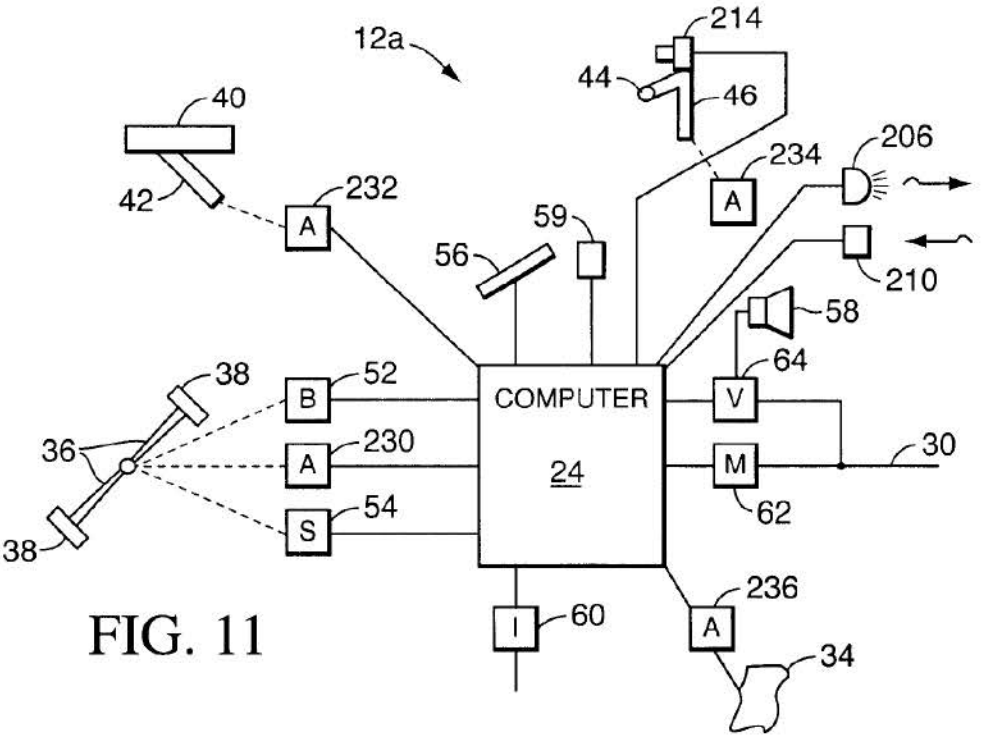
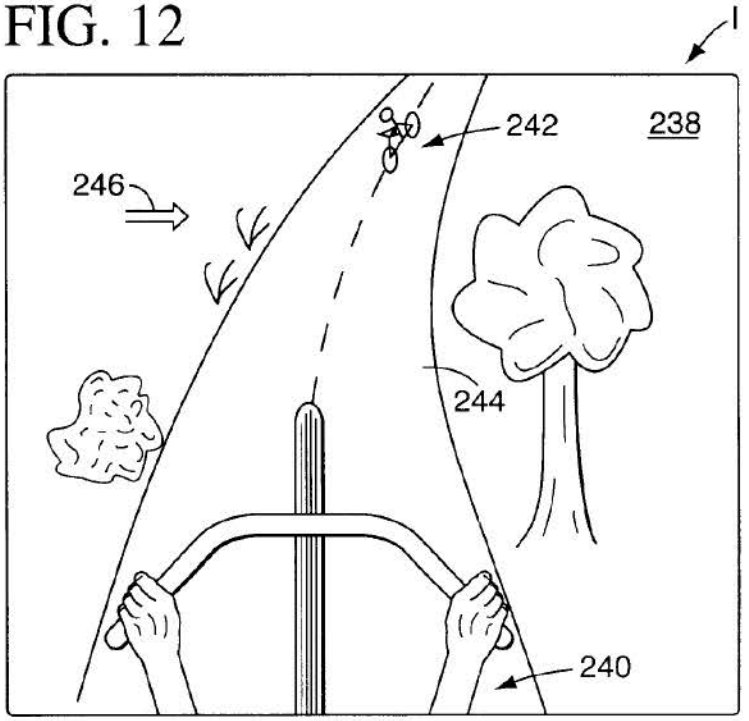

12a
214
44
46
40
42
232
A
234
A
206
210
59
56
58
64
38
52
B
COMPUTER
24
V
36
230
A
M
30
54
S
62
38
236
60
I
A
34

FIG. 11

FIG. 12


I
90
242
238
246
244
240

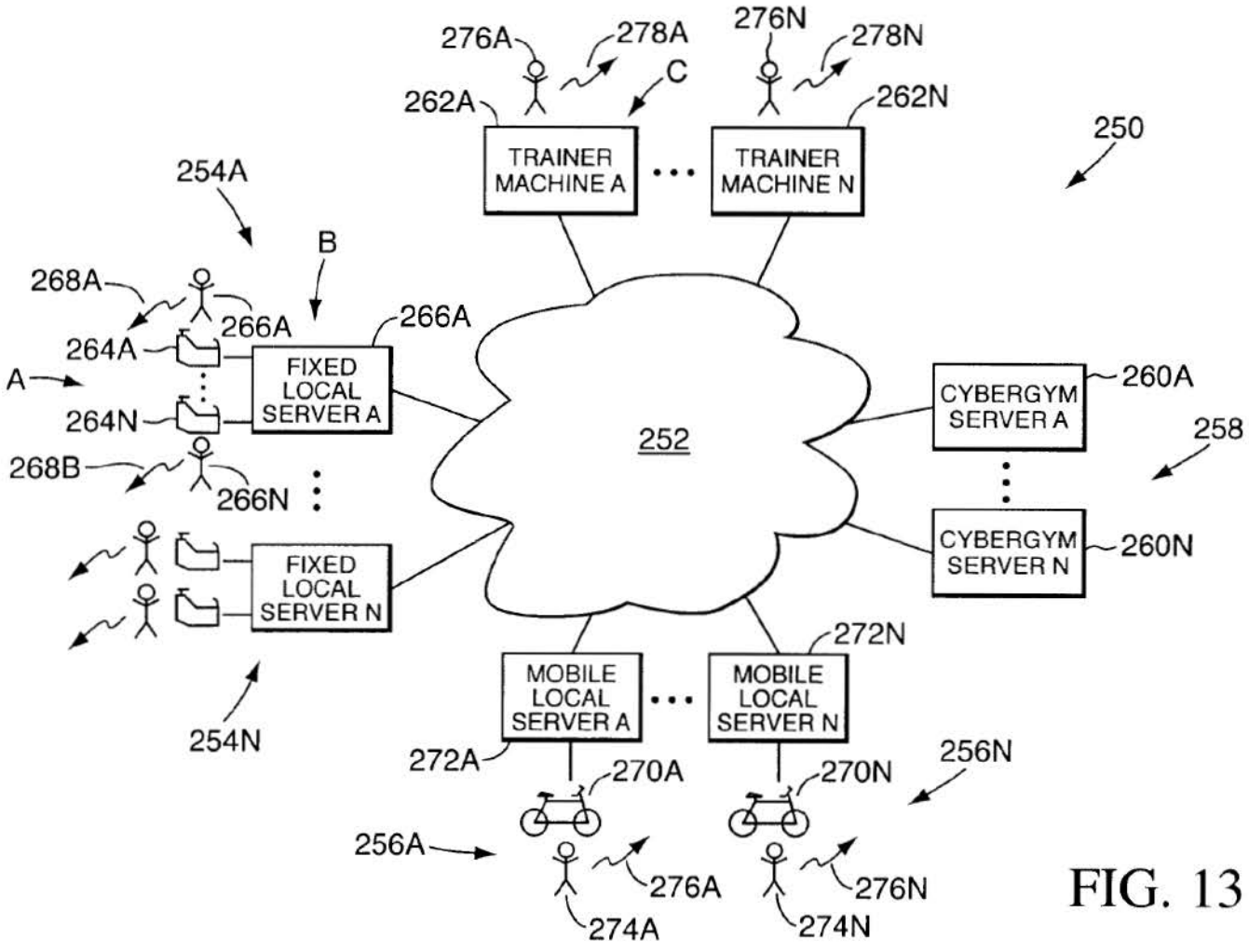

276A
278A
C
276N
278N
262A
262N
TRAINER MACHINE A
TRAINER MACHINE N
250
254A
B
268A
266A
266A
264A
FIXED LOCAL SERVER A
A
264N
252
CYBERGYM SERVER A
260A
258
268B
266N
CYBERGYM SERVER N
260N
FIXED LOCAL SERVER N
272N
MOBILE LOCAL SERVER A
MOBILE LOCAL SERVER N
254N
272A
270A
270N
256N
256A
276A
276N
274A
274N

FIG. 13

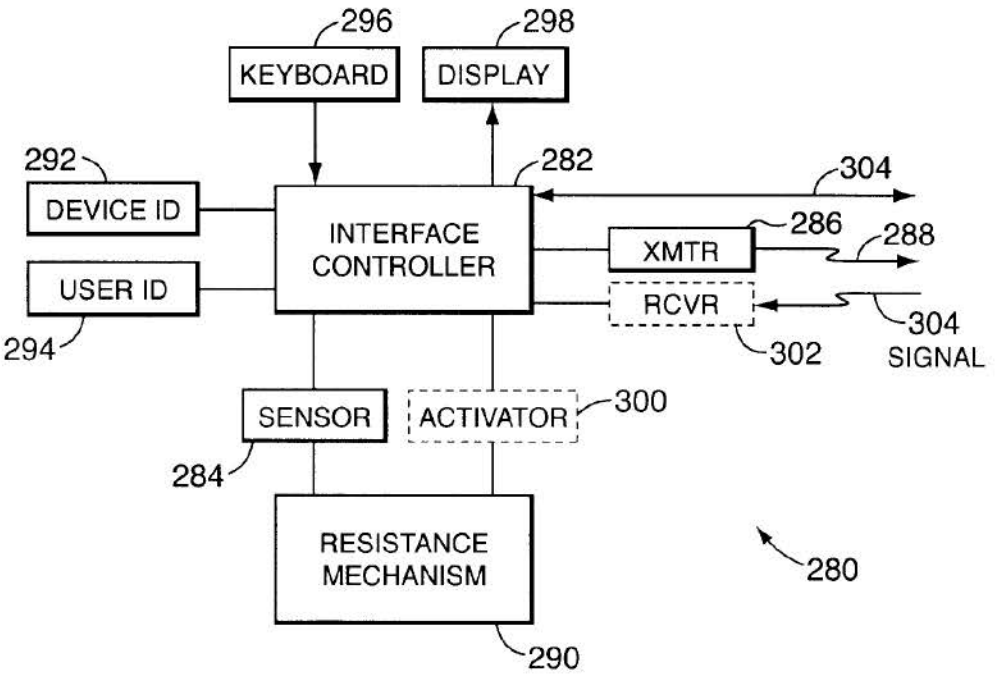

296
298
KEYBOARD
DISPLAY
292
282
304
DEVICE ID
INTERFACE CONTROLLER
286
288
XMTR
USER ID
RCVR
304
SIGNAL
294
302
SENSOR
ACTIVATOR
300
284
RESISTANCE MECHANISM
280
290

FIG. 14

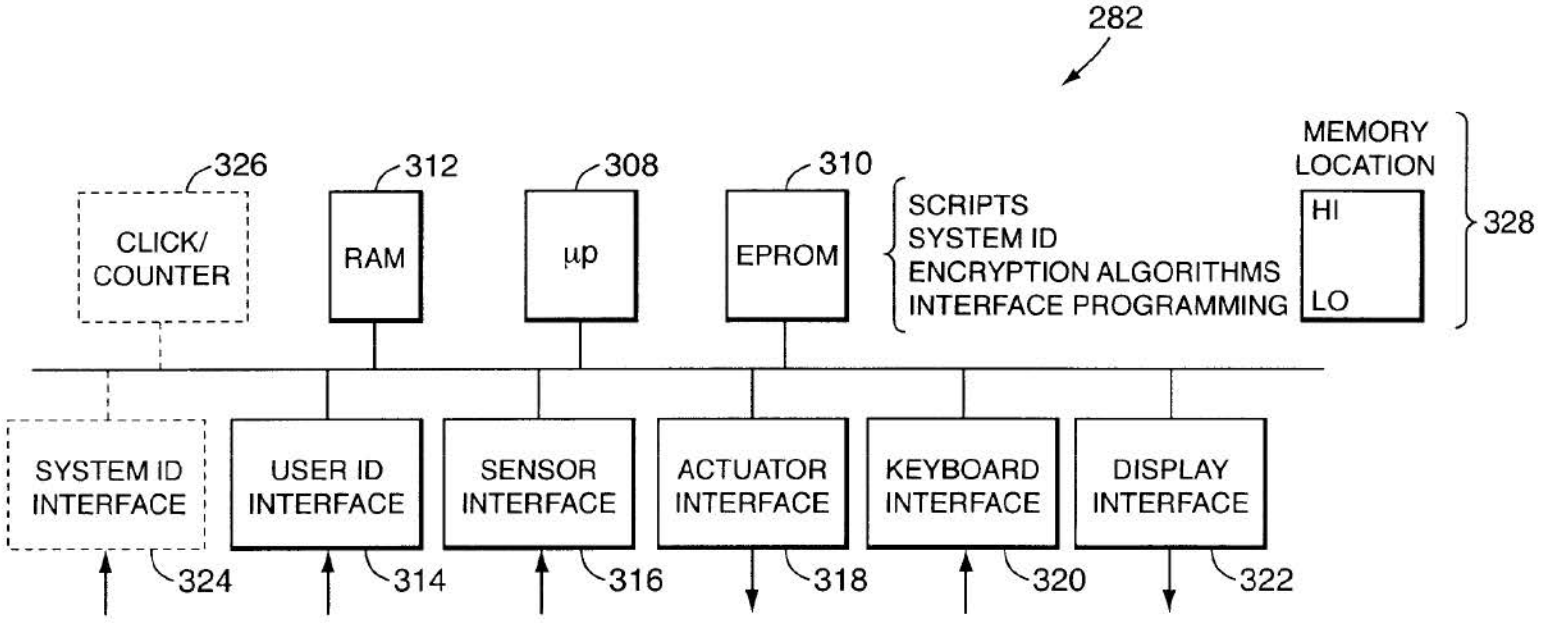

282
326
312
308
310
MEMORY LOCATION
CLICK/ COUNTER
RAM
µp
EPROM
SCRIPTS
SYSTEM ID
ENCRYPTION ALGORITHMS
INTERFACE PROGRAMMING
HI
LO
328
SYSTEM ID INTERFACE
USER ID INTERFACE
SENSOR INTERFACE
ACTUATOR INTERFACE
KEYBOARD INTERFACE
DISPLAY INTERFACE
324
314
316
318
320
322

FIG. 15

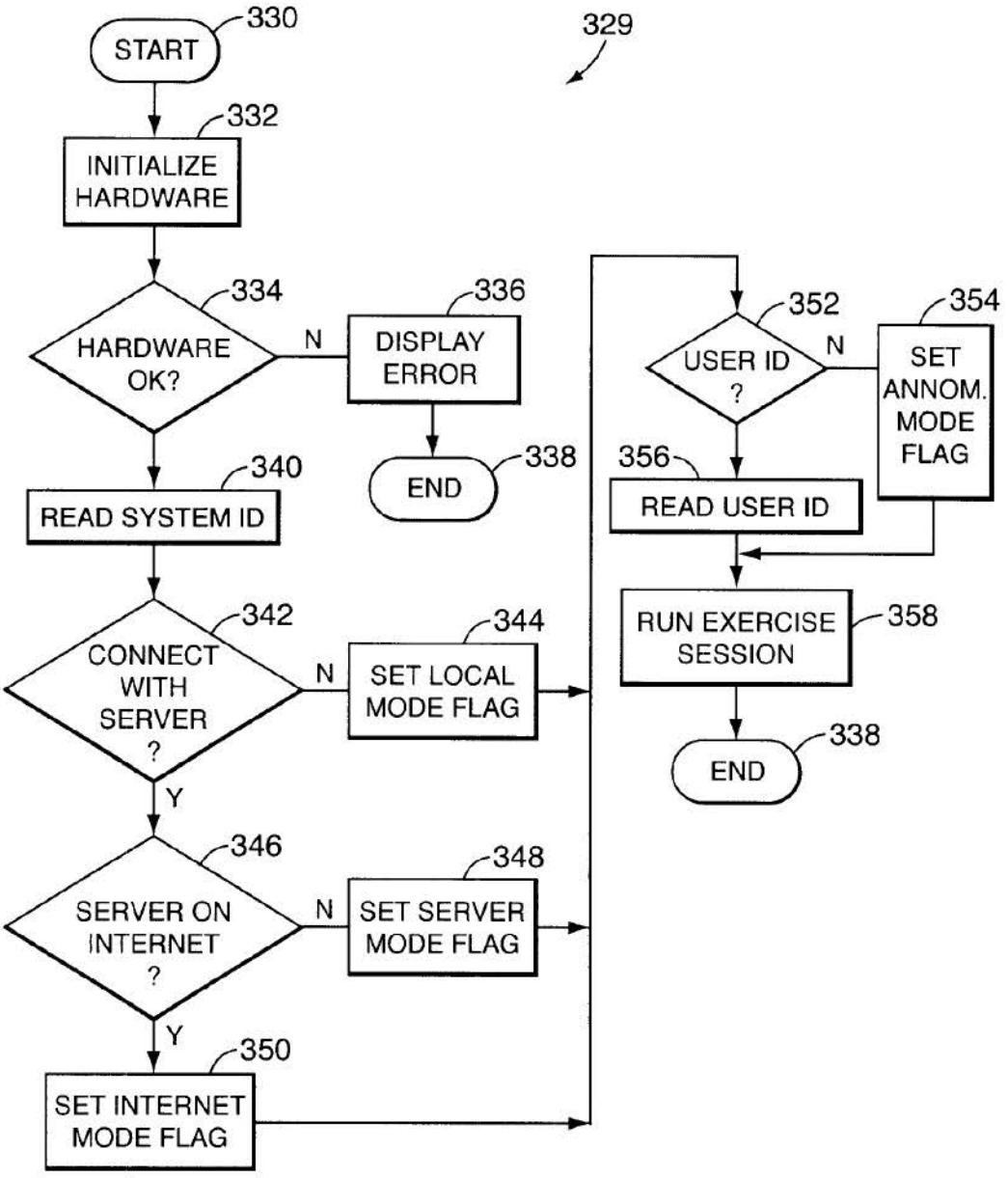

329
START
330
INITIALIZE HARDWARE
332
HARDWARE OK?
334
N
DISPLAY ERROR
336
END
338
READ SYSTEM ID
340
CONNECT WITH SERVER ?
342
N
SET LOCAL MODE FLAG
344
Y
SERVER ON INTERNET ?
346
N
SET SERVER MODE FLAG
348
Y
SET INTERNET MODE FLAG
350
USER ID ?
352
N
SET ANNOM. MODE FLAG
354
READ USER ID
356
RUN EXERCISE SESSION
358
END
338

FIG. 16

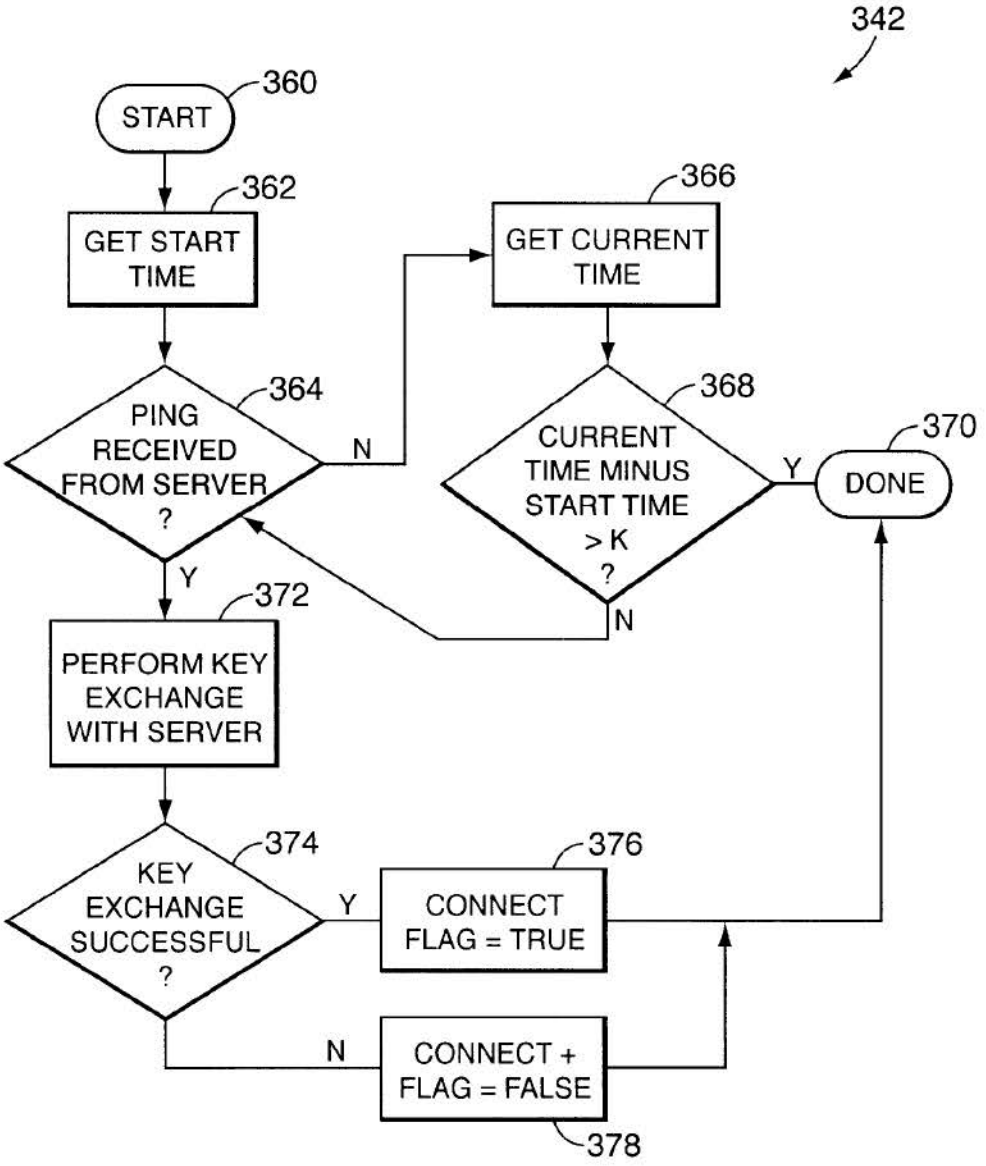

342
START
360
GET START TIME
362
PING RECEIVED FROM SERVER ?
364
N
GET CURRENT TIME
366
CURRENT TIME MINUS START TIME > K ?
368
Y
DONE
370
N
Y
PERFORM KEY EXCHANGE WITH SERVER
372
KEY EXCHANGE SUCCESSFUL ?
374
Y
CONNECT FLAG = TRUE
376
N
CONNECT + FLAG = FALSE
378

FIG. 17

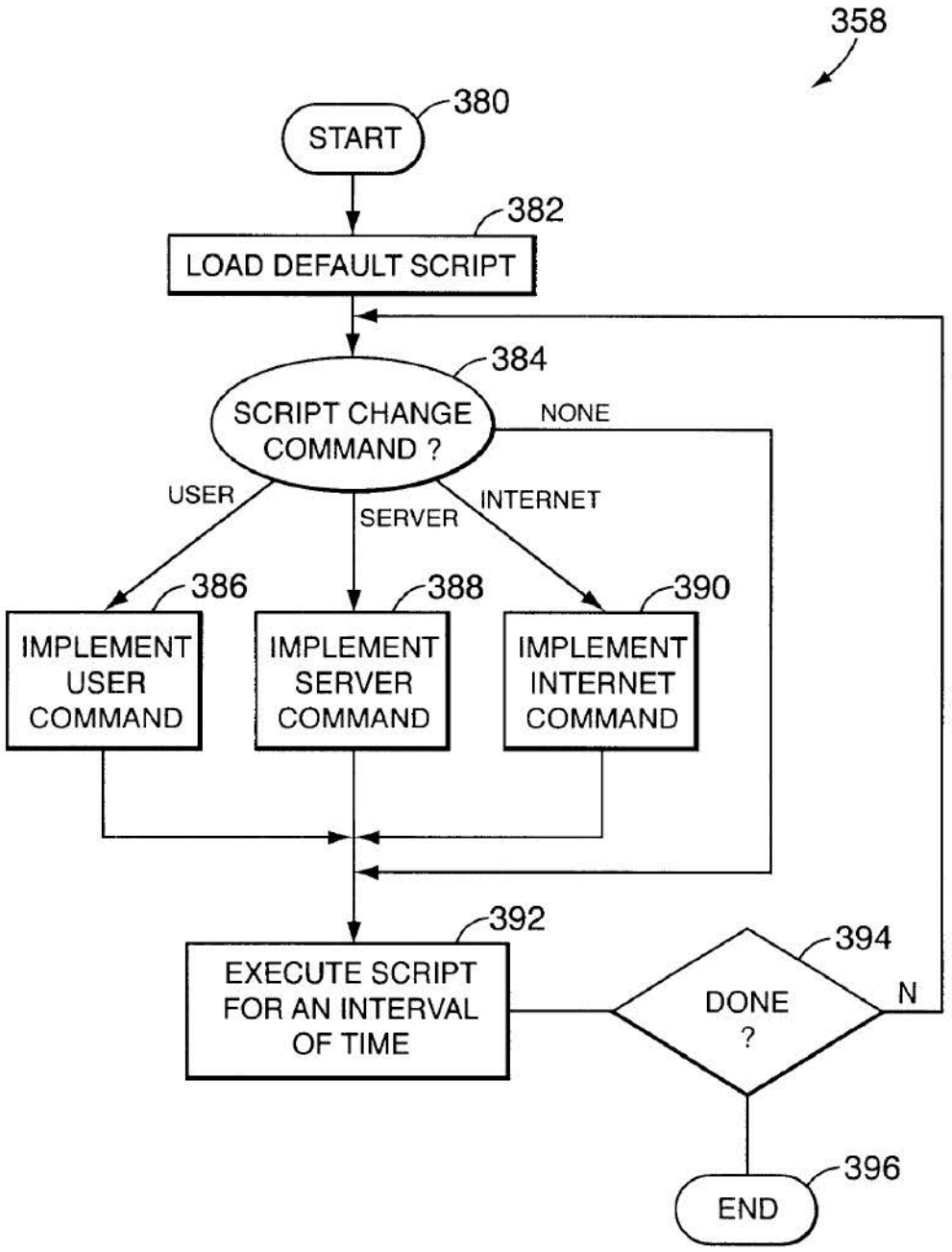

358
380
START
382
LOAD DEFAULT SCRIPT
384
SCRIPT CHANGE COMMAND ?
NONE
USER
SERVER
INTERNET
386
388
390
IMPLEMENT USER COMMAND
IMPLEMENT SERVER COMMAND
IMPLEMENT INTERNET COMMAND
392
EXECUTE SCRIPT FOR AN INTERVAL OF TIME
394
DONE ?
N
396
END

FIG. 18

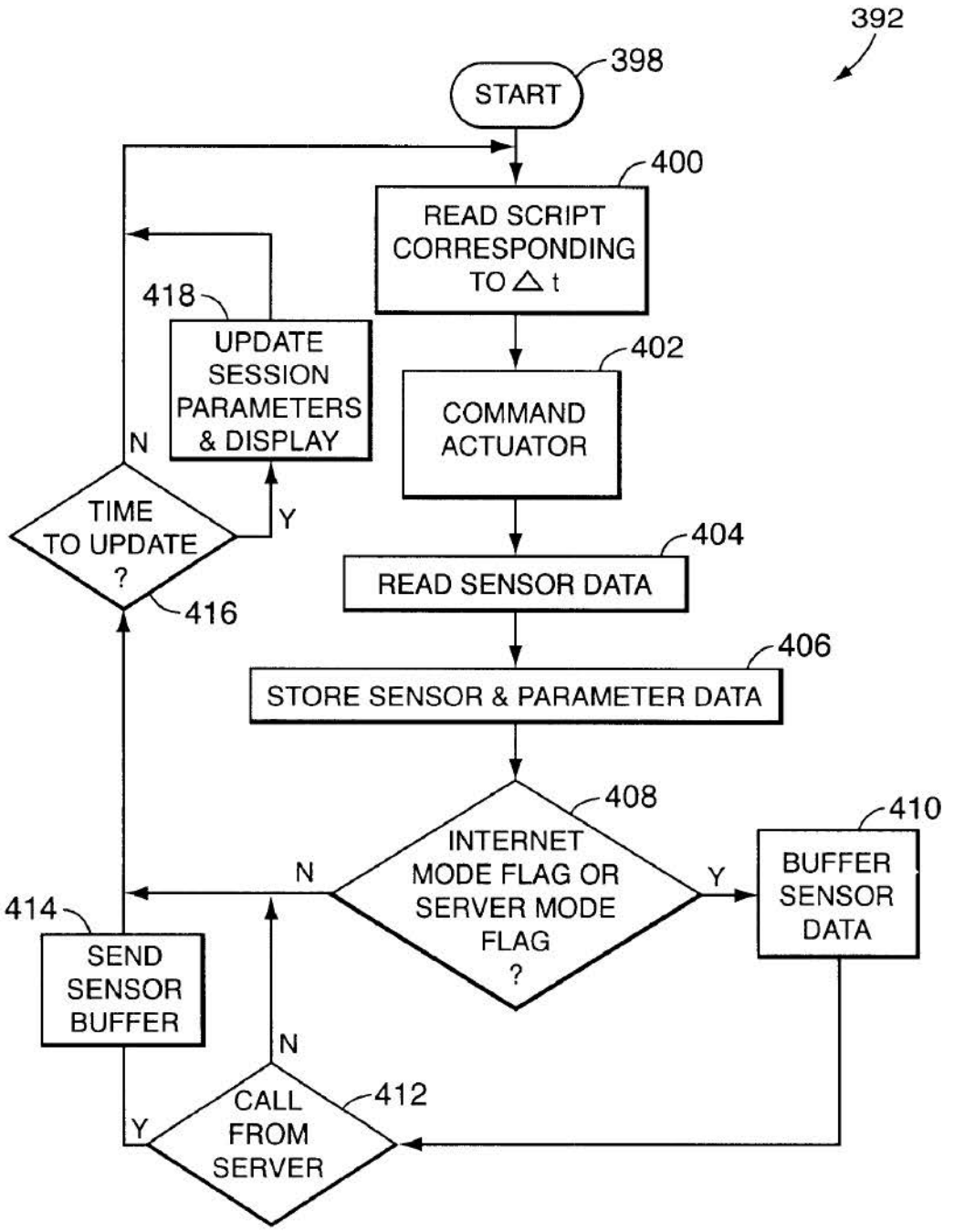

392
START
398
READ SCRIPT CORRESPONDING TO △t
400
COMMAND ACTUATOR
402
READ SENSOR DATA
404
STORE SENSOR & PARAMETER DATA
406
INTERNET MODE FLAG OR SERVER MODE FLAG ?
408
BUFFER SENSOR DATA
410
CALL FROM SERVER
412
SEND SENSOR BUFFER
414
TIME TO UPDATE ?
416
UPDATE SESSION PARAMETERS & DISPLAY
418
Y
N
Y
N
Y
N

FIG. 19

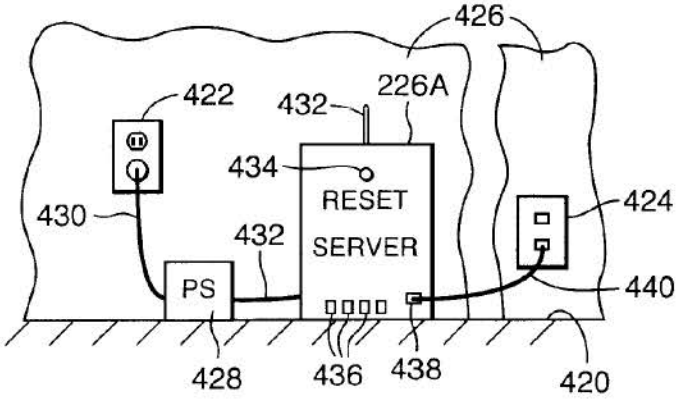

426
422
432
226A
434
RESET
SERVER
430
432
424
PS
440
428
436
438
420

FIG. 20

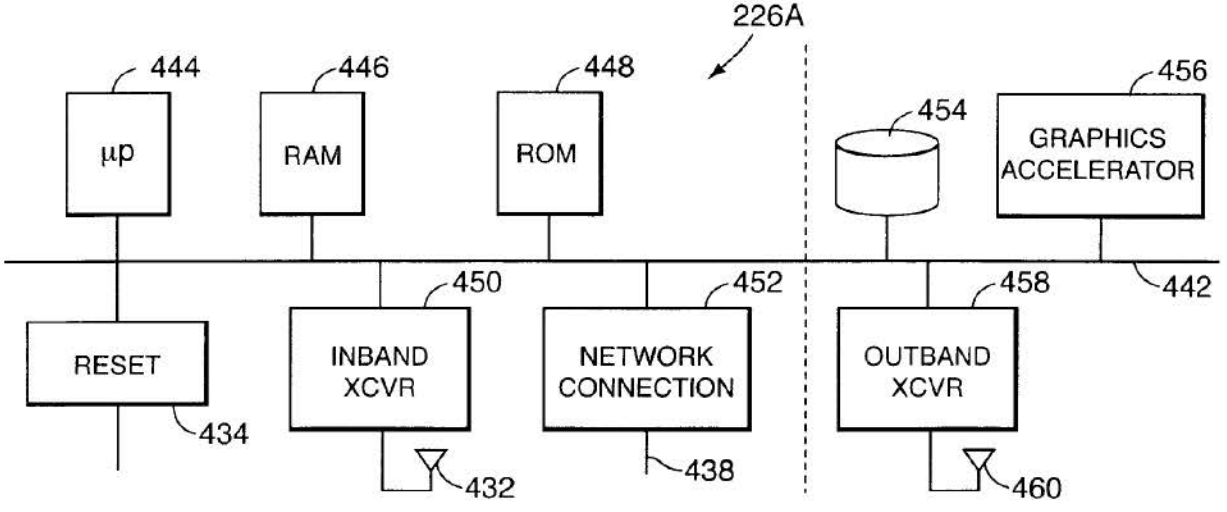
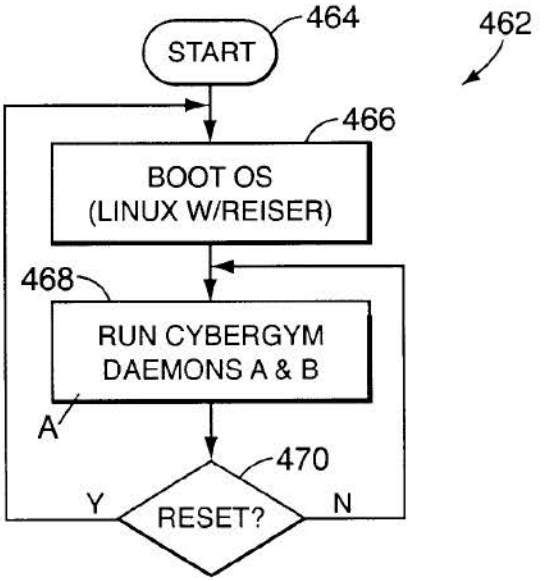

226A
444
446
448
456
454
μp
RAM
ROM
GRAPHICS
ACCELERATOR
450
452
458
442
RESET
INBAND
XCVR
NETWORK
CONNECTION
OUTBAND
XCVR
434
432
438
460

FIG. 21

FIG. 22


462
464
START
466
BOOT OS
(LINUX W/REISER)
468
RUN CYBERGYM
DAEMONS A & B
A
470
RESET?
Y
N

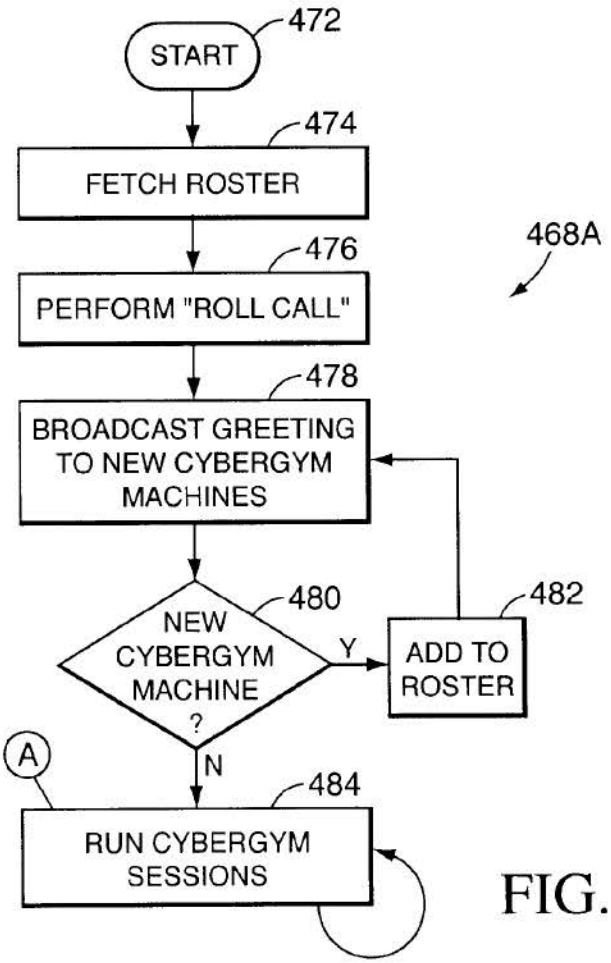

472
START
474
FETCH ROSTER
468A
476
PERFORM "ROLL CALL"
478
BROADCAST GREETING
TO NEW CYBERGYM
MACHINES
480
NEW
CYBERGYM
MACHINE
?
Y
482
ADD TO
ROSTER
A
N
484
RUN CYBERGYM
SESSIONS

FIG. 23

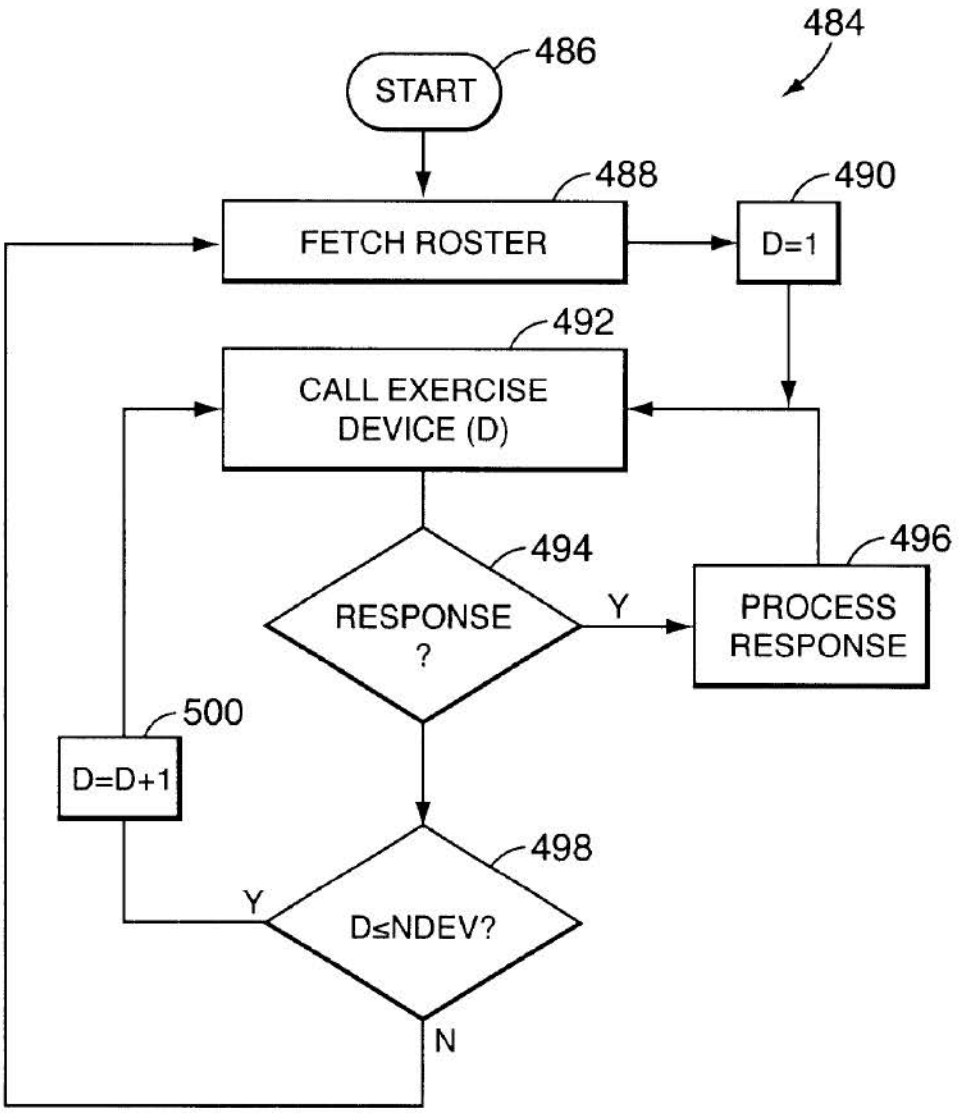
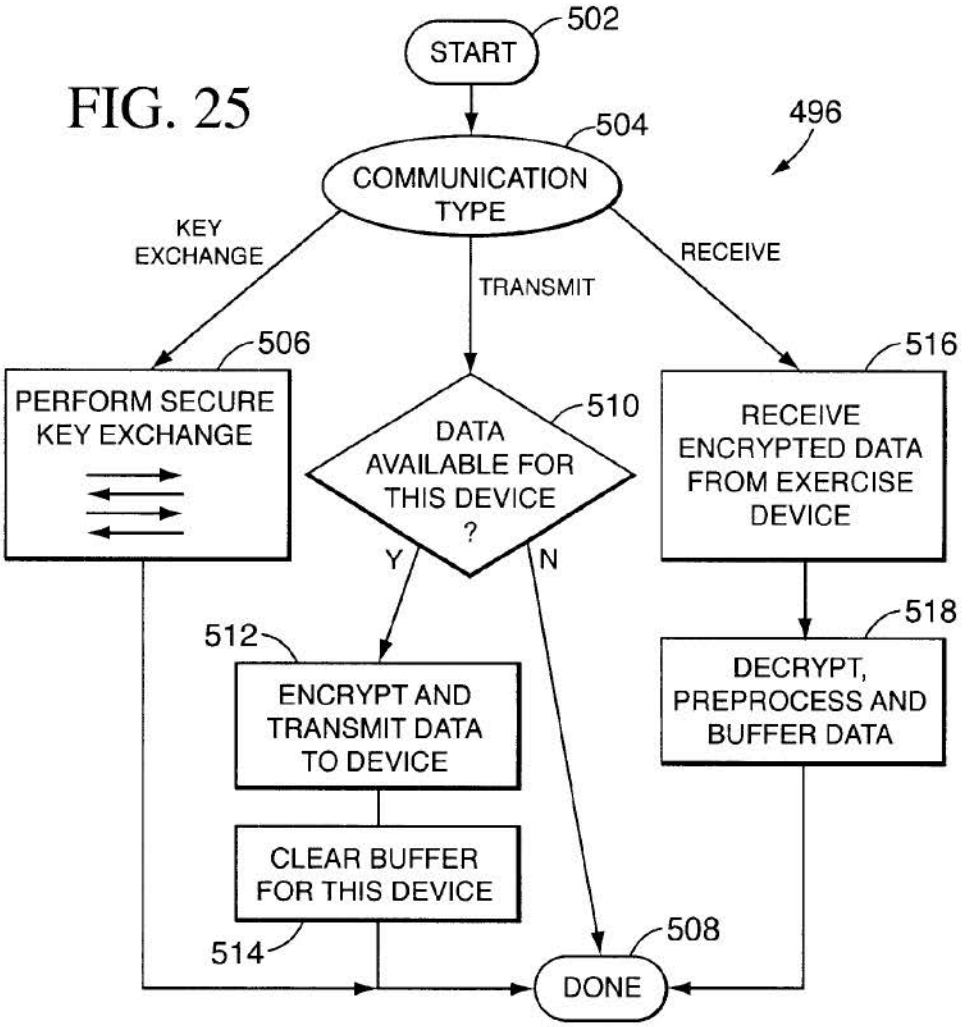

484
START
486
FETCH ROSTER
488
D=1
490
CALL EXERCISE DEVICE (D)
492
RESPONSE ?
494
Y
PROCESS RESPONSE
496
D=D+1
500
D≤NDEV?
498
Y
N

FIG. 24

FIG. 25



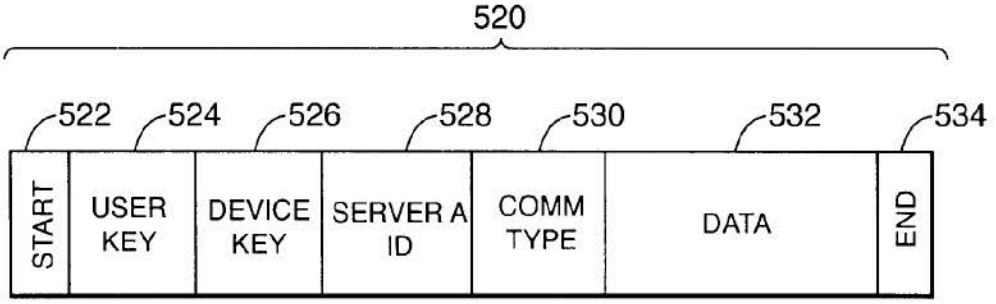


FIG. 25A

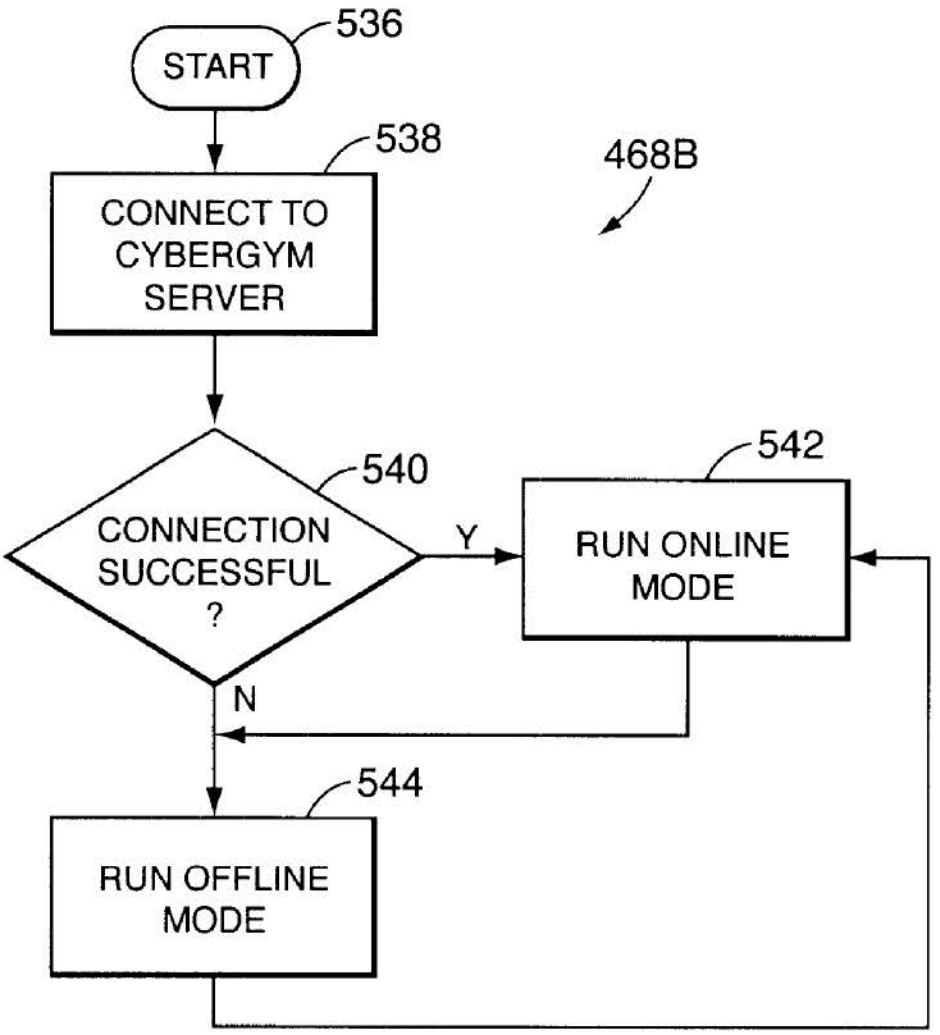

536
START
538
CONNECT TO CYBERGYM SERVER
468B
540
CONNECTION SUCCESSFUL ?
Y
542
RUN ONLINE MODE
N
544
RUN OFFLINE MODE

FIG. 26

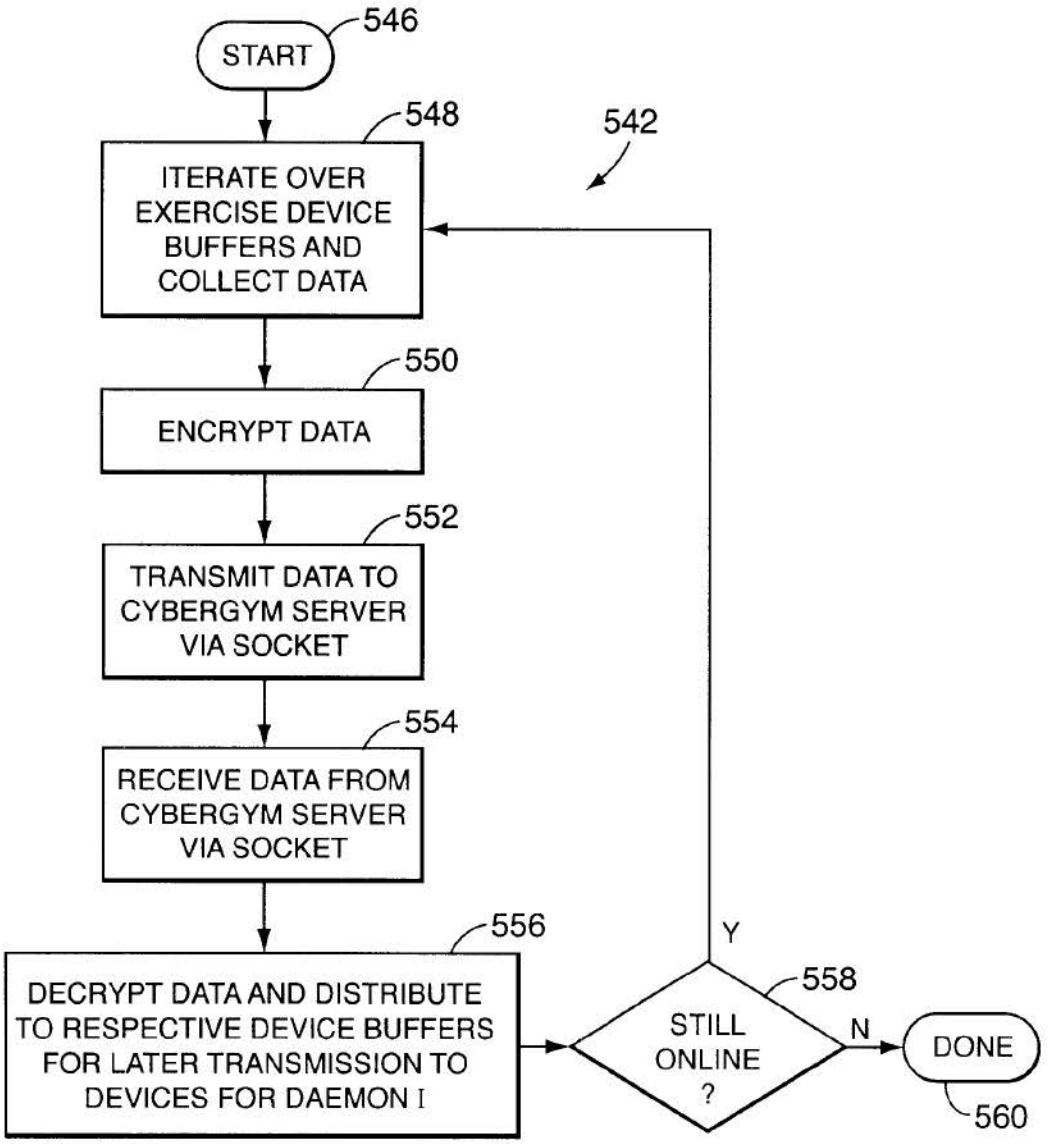

546
START
548
542
ITERATE OVER EXERCISE DEVICE BUFFERS AND COLLECT DATA
550
ENCRYPT DATA
552
TRANSMIT DATA TO CYBERGYM SERVER VIA SOCKET
554
RECEIVE DATA FROM CYBERGYM SERVER VIA SOCKET
556
DECRYPT DATA AND DISTRIBUTE TO RESPECTIVE DEVICE BUFFERS FOR LATER TRANSMISSION TO DEVICES FOR DAEMON I
Y
558
STILL ONLINE ?
N
DONE
560

FIG. 27

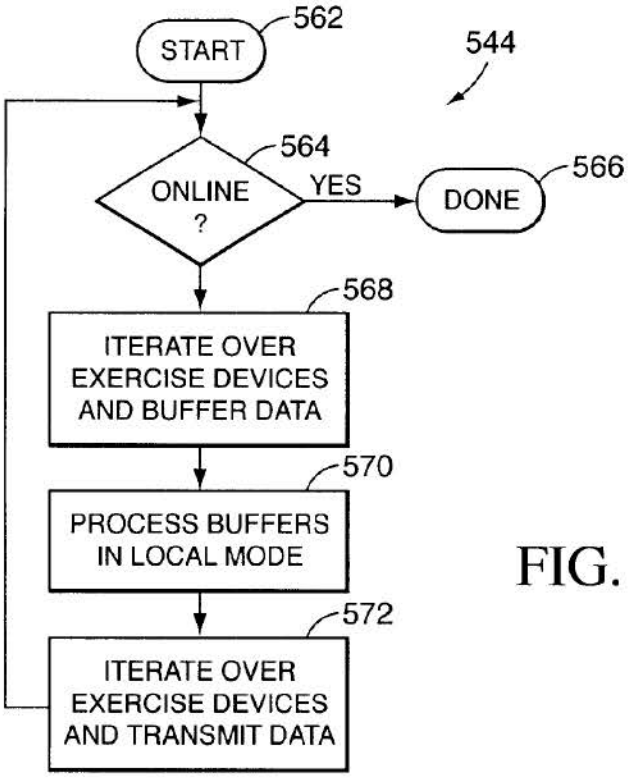


FIG. 28

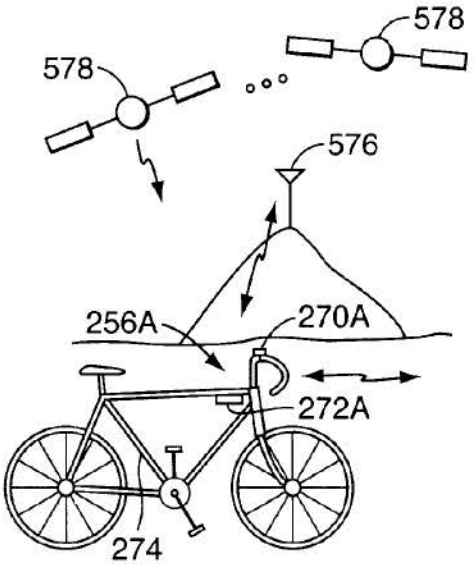


FIG. 29

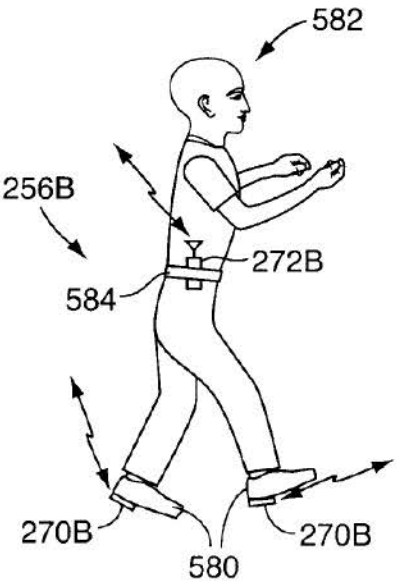


FIG. 30

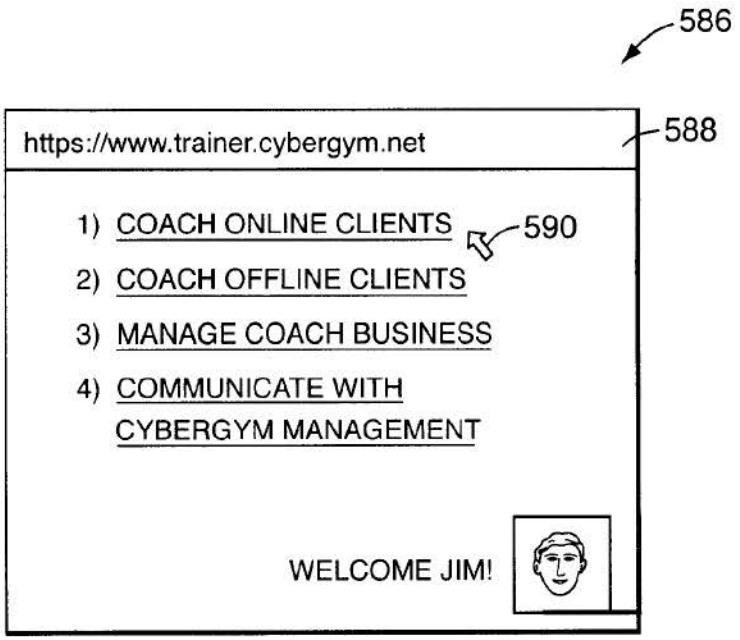

586
https://www.trainer.cybergym.net
588
1) COACH ONLINE CLIENTS
590
2) COACH OFFLINE CLIENTS
3) MANAGE COACH BUSINESS
4) COMMUNICATE WITH CYBERGYM MANAGEMENT
WELCOME JIM!

FIG. 31

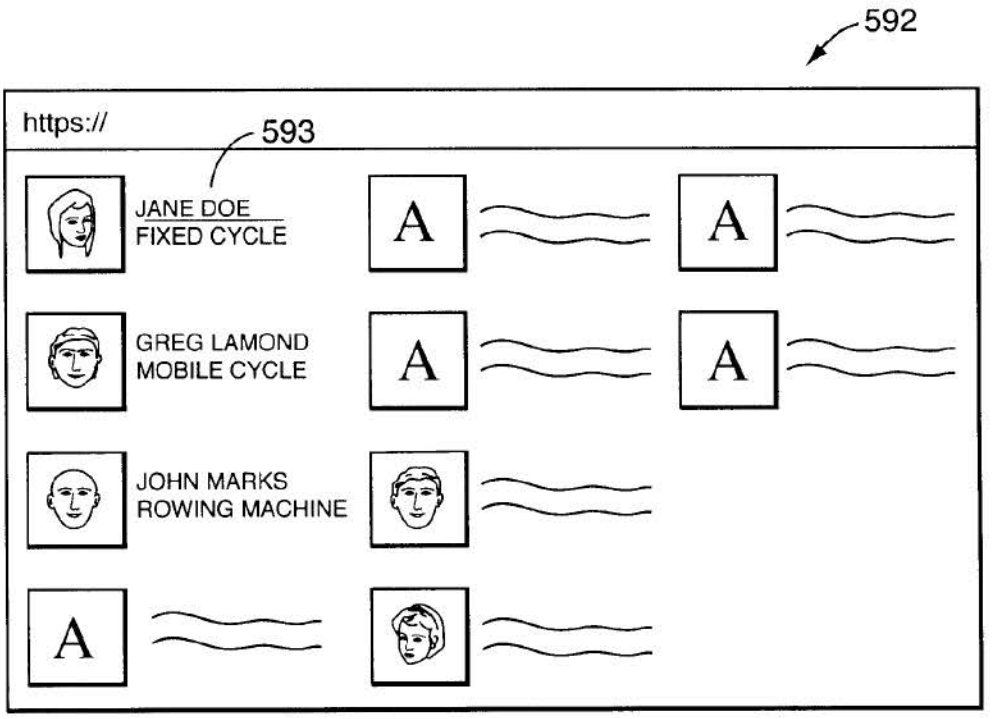

592
https://
593
JANE DOE
FIXED CYCLE
A
A
GREG LAMOND
MOBILE CYCLE
A
A
JOHN MARKS
ROWING MACHINE
A

FIG. 32

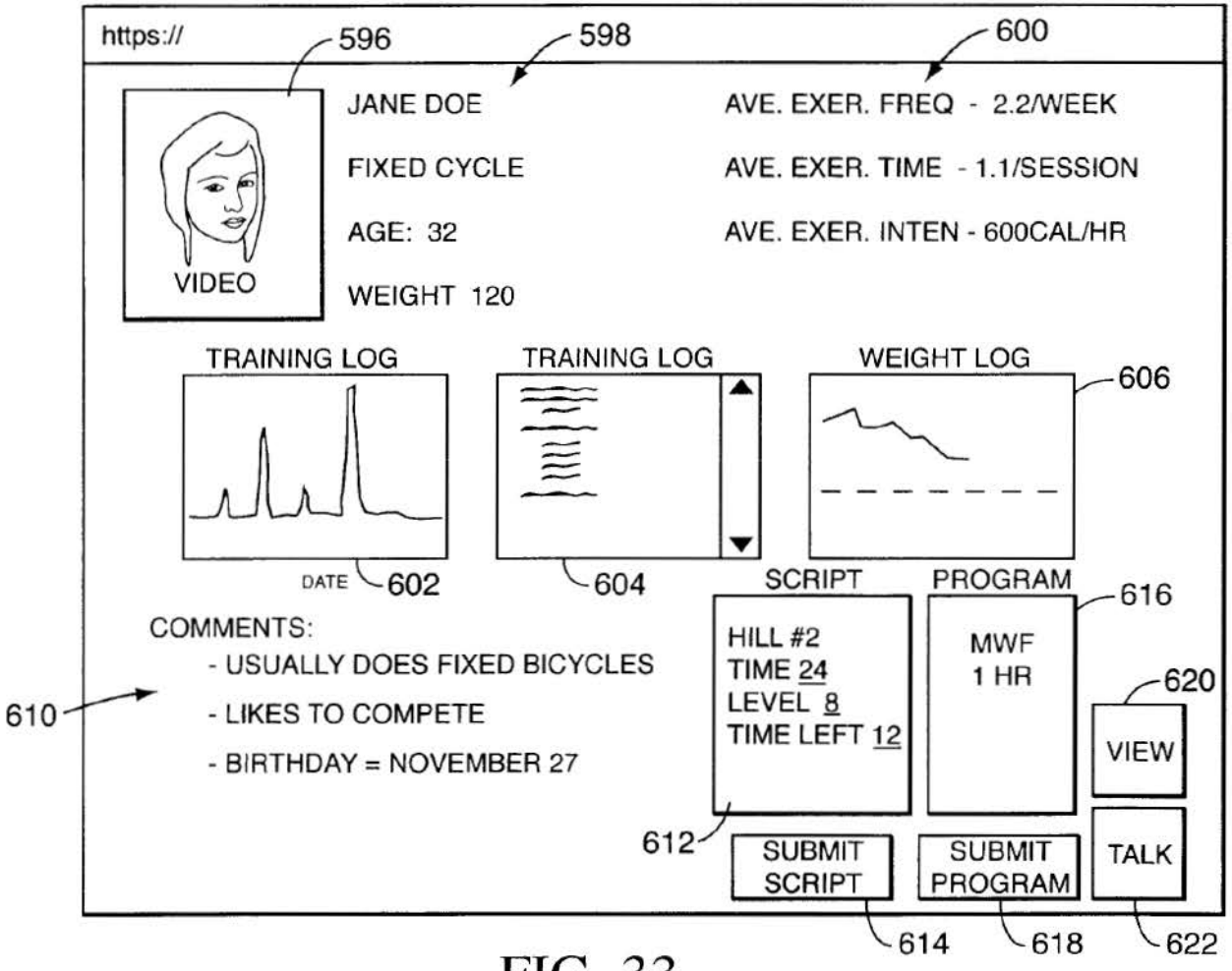

https://
596
598
600
594
JANE DOE
AVE. EXER. FREQ - 2.2/WEEK
FIXED CYCLE
AVE. EXER. TIME - 1.1/SESSION
AGE: 32
AVE. EXER. INTEN - 600CAL/HR
VIDEO
WEIGHT 120
TRAINING LOG
TRAINING LOG
WEIGHT LOG
606
DATE
602
604
SCRIPT
PROGRAM
616
COMMENTS:
- USUALLY DOES FIXED BICYCLES
- LIKES TO COMPETE
- BIRTHDAY = NOVEMBER 27
610
HILL #2
TIME 24
LEVEL 8
TIME LEFT 12
MWF
1 HR
620
VIEW
612
SUBMIT SCRIPT
SUBMIT PROGRAM
TALK
614
618
622

FIG. 33

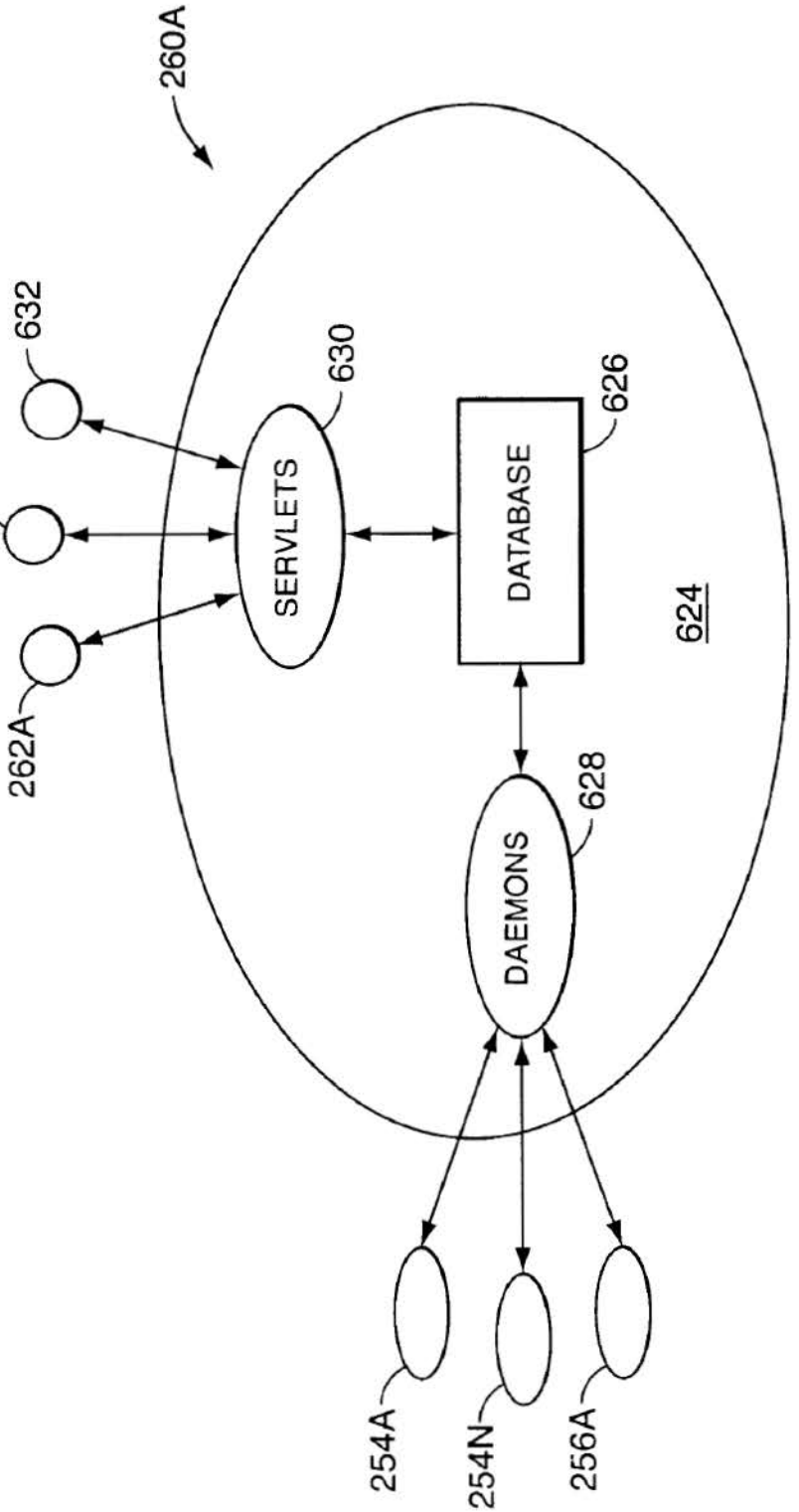

260A
632
630
626
262N
SERVLETS
DATABASE
624
262A
628
DAEMONS
254A
254N
256A

FIG. 34

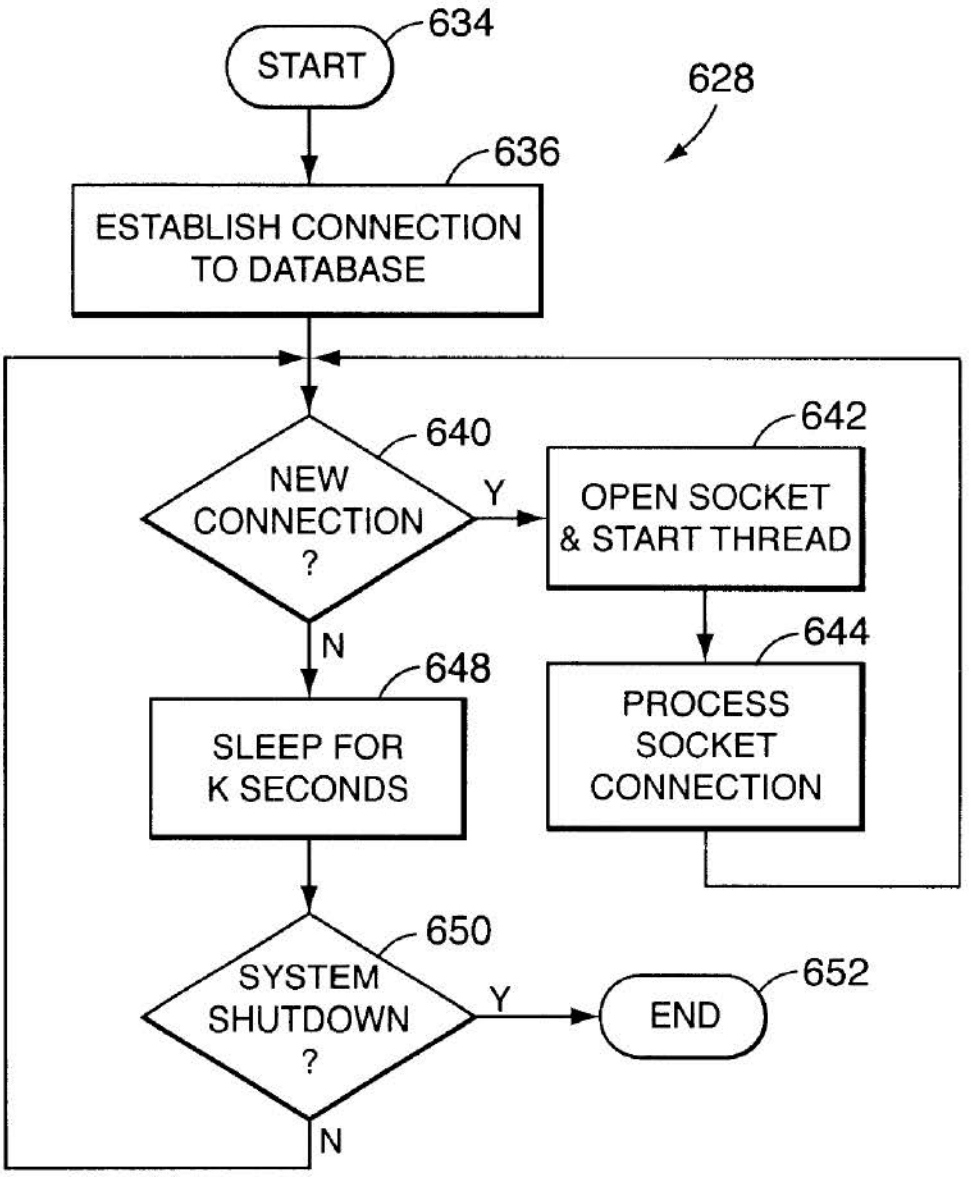

START
634
628
636
ESTABLISH CONNECTION TO DATABASE
640
NEW CONNECTION ?
Y
642
OPEN SOCKET & START THREAD
644
PROCESS SOCKET CONNECTION
N
648
SLEEP FOR K SECONDS
650
SYSTEM SHUTDOWN ?
Y
652
END
N

FIG. 35

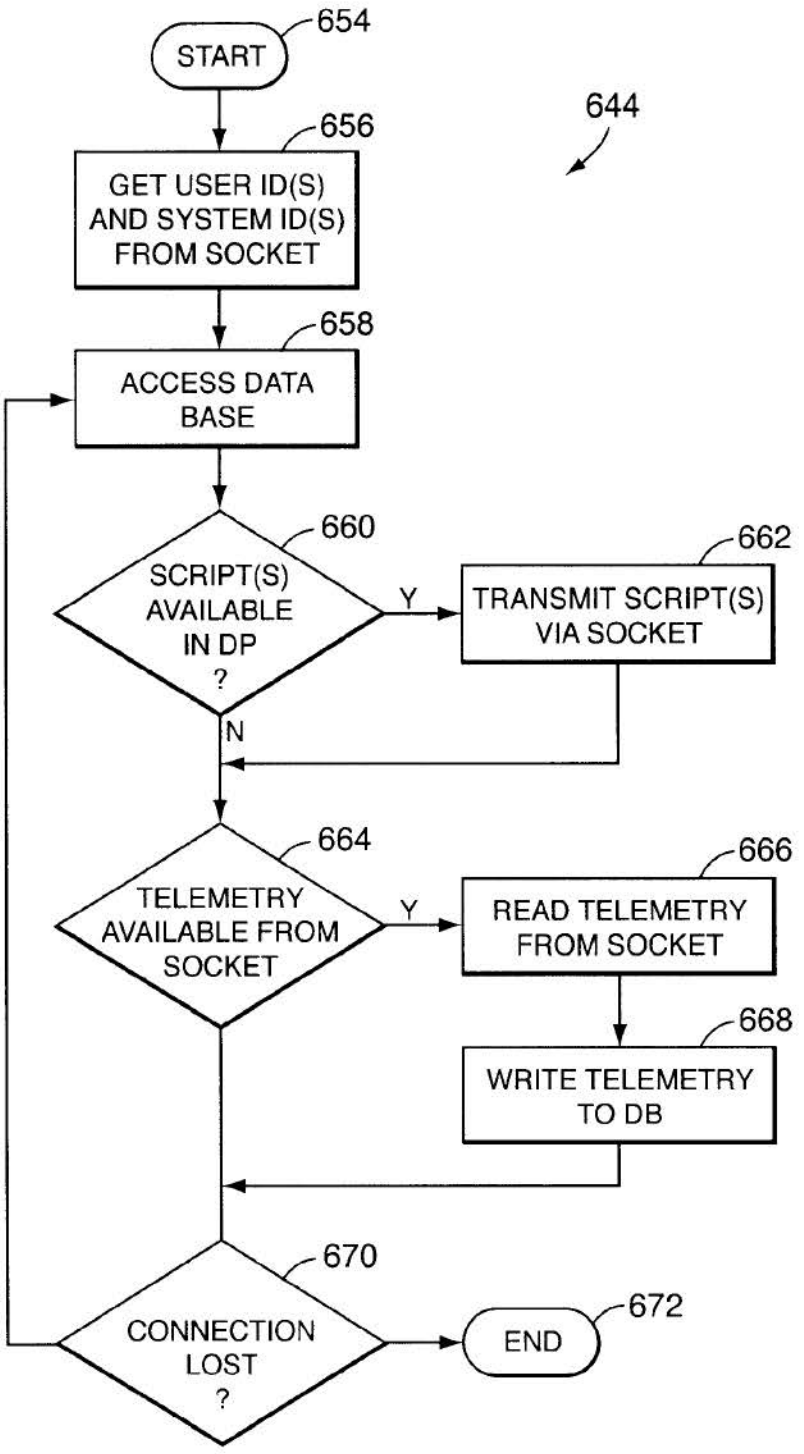

654
START
644
656
GET USER ID(S) AND SYSTEM ID(S) FROM SOCKET
658
ACCESS DATA BASE
660
SCRIPT(S) AVAILABLE IN DP ?
Y
662
TRANSMIT SCRIPT(S) VIA SOCKET
N
664
TELEMETRY AVAILABLE FROM SOCKET
Y
666
READ TELEMETRY FROM SOCKET
668
WRITE TELEMETRY TO DB
670
CONNECTION LOST ?
672
END

FIG. 36

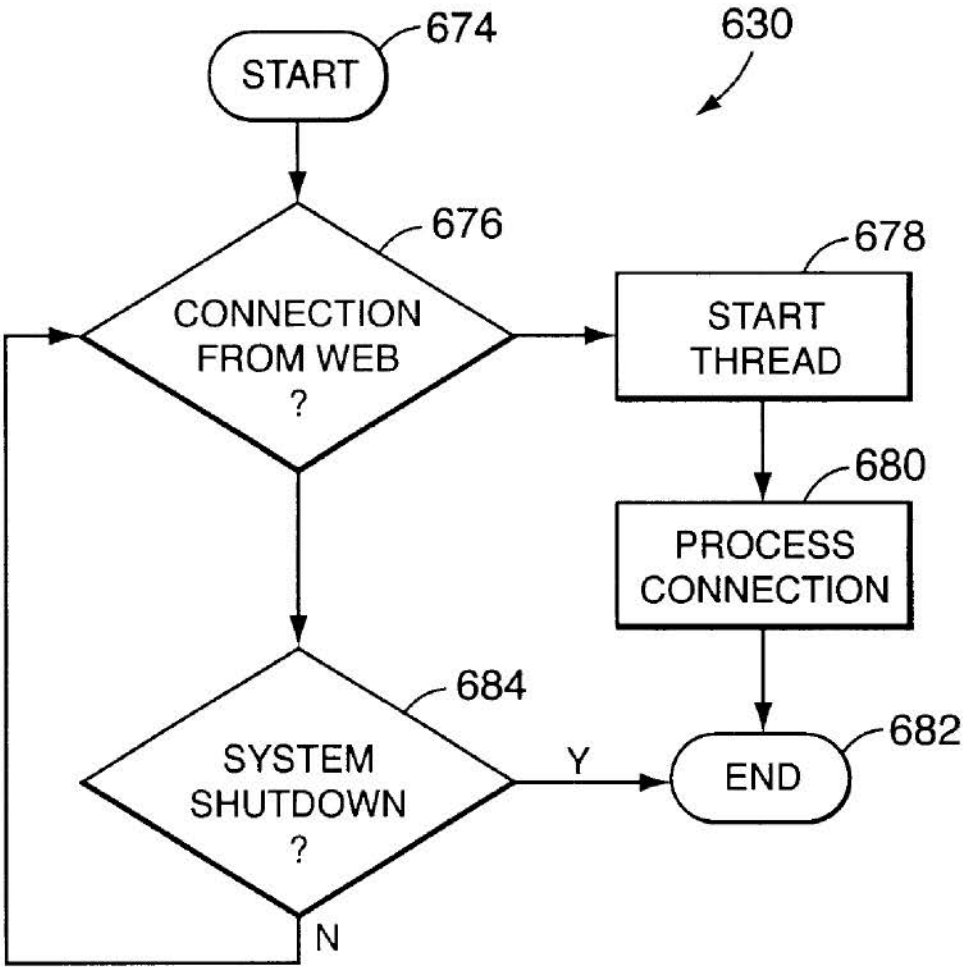

674
START
630
676
CONNECTION FROM WEB ?
678
START THREAD
680
PROCESS CONNECTION
684
SYSTEM SHUTDOWN ?
Y
682
END
N

FIG. 37

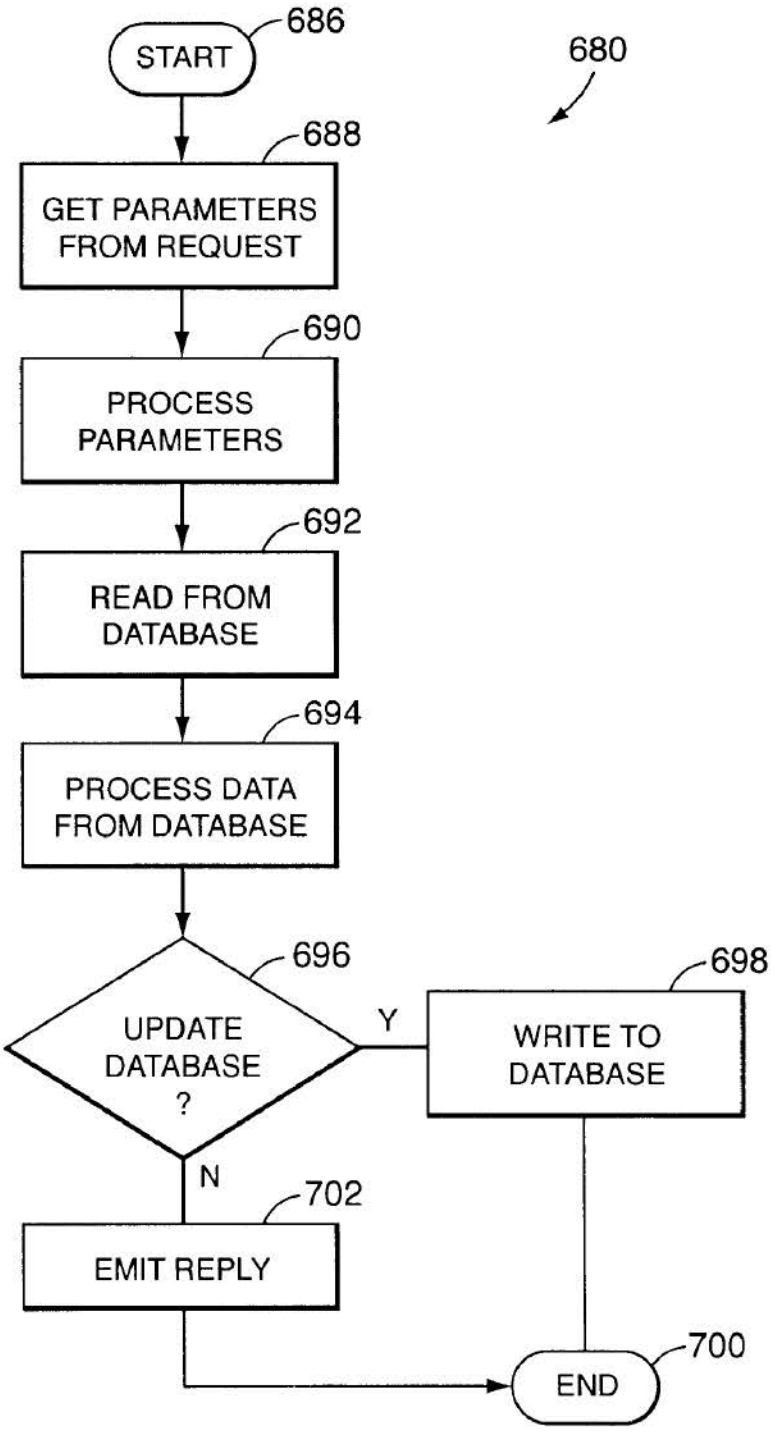

680
START
686
GET PARAMETERS FROM REQUEST
688
PROCESS PARAMETERS
690
READ FROM DATABASE
692
PROCESS DATA FROM DATABASE
694
UPDATE DATABASE ?
696
Y
WRITE TO DATABASE
698
N
EMIT REPLY
702
END
700

FIG. 38

METHOD AND APPARATUS FOR REMOTE INTERACTIVE EXERCISE AND HEALTH EQUIPMENT

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to health and exercise equipment, and more particularly to computer networked systems including health or exercise equipment.

2. Description of the Related Art

Good health is a fundamental requirement for a happy and long life. A multi-billion dollar health and fitness industry has grown to help individuals meet this requirement. For example, there are a great many gymnasiums which provide facilities and equipment for aerobic and musculature development, and there are hundreds, if not thousands, of weight loss and diet centers and programs. The goals of these many programs typically include weight loss and/or maintenance, the improvement of aerobic fitness, improved circulation, increased strength, and body building or shaping.

There are several problems encountered with the use of gymnasiums, fitness centers, and diet centers. For one, they tend to be fairly expensive due to the need to maintain the facilities, pay rent and payroll, buy equipment, etc. In addition, these centers tend to be inconvenient in that they require a special trip to the center by individuals wishing to use their facilities. Both the price and the inconvenience tend to discourage use of these centers over time, allowing the individuals to lose incentive and drop out of their fitness or diet program.

A partial solution to this problem is home exercise and health equipment. Again, a large industry has arisen to provide exercise and health equipment for the home. This equipment tends to be more of the aerobic type, e.g. stationary bicycles, rowing machines, "step" machines, etc., although weight lifting apparatus, sometimes referred to as "resistance trainers," are also widely used in the home. These types of home exercise and health equipment increasingly use sophisticated electronics, such as microprocessors, to monitor the level of exercise and to provide exercise programs for the user.

Unfortunately, even well designed home exercise and health equipment often fall into disuse over time. This is because individuals, even in their own home, often lack the incentive to exercise when there are other, more enjoyable, activities available. Also, since there is typically not the camaraderie often found in a health club, diet center, etc., it is easier for users, as individuals, to discontinue their exercise or diet program.

Personal trainers have been used both at fitness clubs and in the home. Personal trainers are individuals who usually have a fitness training background and who typically provide personal training services to an individual customers. Personal trainers can be very effective in that they provide personal motivation and feedback to an individual in the exercise program, and thus often foster a more effective and longer-lasting exercise program. The downside of personal trainers is, particularly in the home setting, their relatively high cost. It is not unusual for a personal trainer to charge hundreds of dollars per month for their services. Therefore, while these personal trainers are very effective, they tend to be used by only a small percentage of the population.

It is also desirable to make exercise more of a group experience. It is well established that people are more likely

to exercise in a group setting than they are on their own. With stationary exercise equipment this, in the past, could only be accomplished by physically locating the exercise apparatus near to each other, e.g. in a health club setting. With mobile exercise equipment, the exercisers would have to group together, such as assembling a group for bicycle ride. In either case, the ability to share a group exercise experience required users to physically get together. Also, such group exercise experiences were typically limited to sametype exercise equipment. That is, bicycle riders rode with bicycle riders, swimmers swam with swimmers, etc.

Even the individual and group experiences within a gymnasium or health club can be somewhat lacking. The exercise equipment are typically stand-alone, without allowing for the gathering of exercise session parameters, interactivity, remote communications, etc. It would be desirable to have such experiences expanded with enhanced capabilities as well.

SUMMARY OF THE INVENTION

The present invention provides an exercise and health system which is convenient, affordable, and effective. The system includes computerized exercise and/or health equipment (the "local system") that can provide feedback and encouragement to the user, i.e. can serve as a "virtual personal trainer." These local systems often include a local server to service multiple exercise devices. In addition, the system includes a remote system communicating over a bi-directional data channel (preferably the Internet) with the exercise and health equipment. This remote system can include remote servers communicating with the local system, and remote work stations used by trainers and users to interact with the remote servers and local systems.

Since the exercise and health equipment can communicate with the user, it is possible for the health equipment to provide incentive and motivation to the user much in the same fashion as a human personal trainer. In addition, the health and exercise equipment can store data and other parameters concerning the exercise or other activities which can be used to monitor the progress and to vary the exercise program or script. In this way, the local system can serve as a "virtual personal trainer." The data and other parameters can also be stored in the local server and uploaded to the remote server. From there, the data and parameters can be processed and/or accessed from the workstations and the local systems.

The remote server is preferably associated with a number of local systems. The remote server can be considered to be the communication tool of a human personal trainer via a workstation, as opposed to the "virtual personal trainer" emulated by software in the local system. Further, the remote server can provide for competitions and group exercising between virtually any number of users in any number of locations. Some of the users may be in fixed locations (such as on a rowing machine or a stationary bicycle), while other users may be in mobile locations, such as bicyclists and joggers. With appropriate handicapping, a person on a stationary bicycle can race with a person on a road bicycle (or even join the Tour de France), or with a person on a rowing machine. Further, "virtual" competitions can be held wherein an exercise device represents, for example, a spaceship, such that the more energy expended by the user results in faster spaceship movement. Such "virtual" competitions may use standard sensor of the exercise equipment to "steer" the spaceships. For example, a person on a fixed rowing machine could steer by pulling harder on one oar

than another, or "fire" a missile by pushing forward on both oars. However, it is anticipated that various "out of band" signals may also be used to create a virtual competition.

In a preferred embodiment of the present invention, a distributed wide area network (WAN) such as the Internet is used to couple local servers, remote servers, and workstations together. Users at local systems can interact visually and even in a tactile manner with other users over the Internet. For example, a first user at a first local station can take a "virtual ride" with another user at a second local station through the Internet connection. Likewise, a remote "personal trainer" can interact with a user at a local station via the Internet communication linkage.

The systems, methods, and apparatus of the present invention therefore can provide an effective exercise, dietary, and health program for a great number of individuals. The computerized health equipment provides incentive and encouragement to stay in the program, due to the "virtual personal trainer" of the local system, the human personal trainer of the remote system, and by the various services provided by the enterprise as a whole as supported by the server systems, peer systems, etc. For example, a variety of services of products can be offered to the users of the system to further their health and fitness goals. In addition, the camaraderie of exercising with other users can be provided.

The described invention therefore creates a "virtual gymnasium" anywhere and everywhere it is desired. For example, exercise equipment within a traditional gymnasium or health club can interact with exercise equipment that is out of doors or in a home environment. Furthermore, multiple exercise equipment can communicate with a local server (in, for example, a home, gymnasium, or health club setting) for the gathering of exercise session parameters, providing user feedback, generating reports, etc.

It will be appreciated that implementations of the present invention are ubiquitous, appliance-like, and scaleable. In particular, by providing an inexpensive base controller for minimal "in-band" communications, the controller can be provided on virtually every exercise apparatus at minimal cost, leading to the ubiquitous nature of the invention. By providing "plug-and-play" functionality, the system becomes appliance-like. In the wireless embodiments of the local system, a compatible exercise device needs only be brought into proximity with a local server to become a part of the system. Further, the local server has an extremely simple base interface: a reset switch. Of course, additional interfaces such as a touch-screen video display can add further functionality. Finally, the system is scalable because the same base architecture can be used to couple from one piece of exercise equipment to many pieces of exercise equipment to the local and/or remote servers of the system.

These and other advantages of the present invention will become apparent upon the rating of the following descriptions and the study of the figures of the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of a health and fitness system in accordance with the present invention;

FIG. **2** is a block diagram of the local, remote, and server system computers of the present invention;

FIG. **3** is a flow diagram of a process running on a local system computer of the present invention;

FIG. **4** is a flow diagram of the "Process Exercise Activity" operation of FIG. **3**;

FIG. **5** is a flow diagram of the "Detect And Record User Activity, Provide Feedback" operation of FIG. **4**;

FIG. **6** is a flow diagram of a "Process Local System Activity" operation of FIG. **3**;

FIG. **7** is a flow diagram of the "Process Remote Activity" operation of FIG. **3**;

FIG. **8** is a flow diagram of a process running on a remote system computer of the present invention;

FIGS. **8***a*, **8***b*, and **8***c* are three examples of data analysis performed in the "Process Data" operation **176** of FIG. **8**;

FIG. **9** is a flow diagram of a process running on a server system computer of the present invention;

FIG. **10** is an illustration of a local system connected to other local systems, remote systems, and server systems via the Internet;

FIG. **11** is a block diagram of the local computer of the local system of FIG. **10**;

FIG. **12** is an illustration of a "virtual ride" taking place over the Internet with users using two separate local systems;

FIG. **13** is an illustration of a remote interactive exercise and health system in accordance with the present invention;

FIG. **14** is a block diagram of a preferred control circuitry for an exercise device of the system illustrated in FIG. **13**;

FIG. **15** is a block diagram of a preferred architecture for an interface of FIG. **14**;

FIG. **16** is a flow diagram of a process executed by the microprocessor of FIG. **15**;

FIG. **17** is a flow diagram illustrating the "Connect with Server?" process of FIG. **16** in greater detail;

FIG. **18** is a flow diagram illustrating the "Run Exercise Session" process of FIG. **16** in greater detail;

FIG. **19** is a flow diagram illustrating the "Execute Script" process of FIG. **18** in greater detail;

FIG. **20** is an illustration of a fixed local server of FIG. **13**;

FIG. **21** is a block diagram of the server illustrated in FIG. **20**;

FIG. **22** is a flow diagram of a process implemented by the microprocessor illustrated in FIG. **21**;

FIG. **23** is a flow diagram of the "Run Cybergym Daemon A" of FIG. **22**;

FIG. **24** illustrates the process "Run Cybergym Sessions" of FIG. **23** in greater detail;

FIG. **25** is a flow diagram illustrating the "Process Response" operation of FIG. **24** in greater detail;

FIG. **25A** is an illustration of a transmitted data packet in accordance with the present invention;

FIG. **26** is a flow diagram of the "Run Cybergym Daemon B" of FIG. **22**;

FIG. **27** is a flow diagram illustrating the "Run Online Mode" process of FIG. **26** in greater detail;

FIG. **28** is a flow diagram illustrating the "Run Offline Mode" process of FIG. **26** in greater detail;

FIG. **29** illustrates a first implementation of a mobile local server;

FIG. **30** is an illustration of a second local server of FIG. **13**;

FIG. **31** illustrates a web page that may be displayed on a trainer machine of FIG. **13**;

FIG. **32** illustrates another web page which may be displayed on the trainer machine for coaching online clients;

FIG. **33** is a web page that can be viewed on a trainer machine for coaching an individual client;

FIG. **34** is an illustration of a Cybergym™ server of the present invention;

FIG. **35** is a flow diagram illustrating the operation of the daemon of FIG. **34** in greater detail;

FIG. **36** is a flow diagram illustrating the "Process Socket Connection" operation of FIG. **34** in greater detail;

FIG. **37** is a flow diagram illustrating the servlet process of FIG. **34** in greater detail; and

FIG. **38** is a flow diagram illustrating the "Process Connection" operation of FIG. **37** in greater detail.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. **1**, a health and fitness system **10** in accordance with the present invention includes one or more local systems **12**, one or more remote systems **14**, and one or more server systems **16**. The local systems **12** are typically home-based systems designed for the promotion of the health and fitness of individual users within a family. The remote systems **14** may be home or business based, and are used as data gathering and storage stations, as well as communication stations, between a human personal trainer and users of local systems **12**. As will be discussed in greater detail subsequently, the remote system **14** is associated with a relatively large number of local systems **12**, e.g. a personal trainer with a remote system might be in communication with 100 or more individual users of local systems **12**. This is made possible, in part, by providing a "virtual personal trainer" at each of the local stations **12** to partially or fully replace the need for a human personal trainer at the local station. The server systems **16** can communicate with the remote systems **14** to provide server and control functions across the entire enterprise, i.e. over the entire system **10**. As also will be discussed in greater detail subsequently, the server system **16** is associated with a number of remote systems **14**.

The local system **12** includes one or more health or fitness devices such as a stationary bicycle **18**, a weight or "resistance trainer" **20**, a scale **22**, etc. Associated with a local system **12** is a computer **24** which, in this preferred embodiment, is integrated into the stationary bicycle **18**. A stationary bicycle as a "base unit" is given merely by way of example, as any piece of equipment (a rowing machine, a step machine, etc.) could house the computer **24**, or the computer **24** could be housed separately. The computer **24** can serve as a "local server" for other health and fitness devices at local system **12**, such as the weight trainer **20** and the scale **22**. Alternatively, a separate local server **26** can be used to control and/or support various devices in local system **12** via data and control lines **28**, and communicate with the remote system **14** via a telephone line **30** and a modem **32**. However, in the present preferred embodiment, the assumption is that the local server **26** and modem **32** are not required and that the computer **24** will serve not only to control the operation and data gathering function of the stationary bicycle **18**, but will also provide these functions for the weight trainer **20** and the scale **22**. Of course, the weight trainer **20** and the scale **22** may include their own computer systems for local control purposes.

The stationary bicycle **18** includes a housing **34** which, as stated previously, preferably houses the computer **24**, a crank **36** provided with a pair of pedals **38**, a seat **40** supported by a seat stem **42**, handle bar **44** supported by handle bar stem **46**, legs **48**, and feet **50**. The various components of the stationary bicycle **18** are typically attached to a rigid frame that is internally connected to the housing **34**.

The weight trainer **20** is preferably a resistance-type weight trainer, such as a bench press machine, a biceps curl machine, a squat machine, etc. Typically the use grasps a bar connected to a cable that is attached to a resistance device. This resistance device can be weights, or can be an active resistance device such as a motor, or a passive resistance device such as an electrically actuated brake. Active resistance devices are advantageous in that they can provide a force-feedback that can closely mimic real-world conditions, i.e. the actual forces that might be felt by a user when lifting real weights with a human "spotter" or trainer. In any event, the amount of resistance to movement of the bar (or other portions of a piece of exercise equipment) is preferably under the control of the computer **24** and the script that it is running. Particularly with active resistance devices, the control by the local computer is important. This is because a tight feed-back loop between sensors and actuators (such as motors, solenoids, etc.) is desirable to create realistic force feed-back. This would be difficult to accomplish in a realistic manner over a communication linkage, unless such a linkage were extremely fast. However, even in the case of an extremely fast communication linkage, the performance of a remote computer would likely diminish as it was attempting to control even one local system, let alone many local systems. The scale **22** preferably provides an electrical connection to the computer **24** through an I/O port to allow the computer **24** to monitor the weight of the person standing on the scale.

The computer **24** is coupled to a variety of input/output (I/O) devices including a brake **52**, a sensor **54**, a display **56**, a heart rate monitor (HRM) **59**, a loudspeaker **58**, an interface **60**, a modem **62**, and a voice board **64**. In this fashion, the computer **24** can control and monitor the various functions of the stationary bicycle **18**.

More particularly, computer **24** can, under software and hardware control, control the electrically actuated brake **52** which is coupled to the crank **36** of the stationary bicycle. In this fashion, the pedaling force that must be exerted on pedals **38** to cause the crank **36** to rotate at a given speed can be varied under computer control. This electrically actuated brake can be electric/mechanical brake, electric/magnetic brake, etc. as it is well known to those skilled in the art. The brake **52** can be passive (i.e. one that creates a frictional, magnetic or other drag) or active (e.g. a motor/generator that resists the movement of the crank **36**). The sensor **54** is typically used to determine the rotations-per-minute (RPM) of the crank **36**. In this way, the computer **24** can receive information concerning the level of effort being exerted by a user of the stationary bicycle **18**. Rotation sensors are well known those skilled in the art. The sensor **54** can also measure other parameters such as the force (torque) being applied to pedal **38**, again to provide information to the computer as to the level of effort being exerted by the user of the bicycle.

The computer can provide an output on a display **56** that can be viewed by an individual user sitting on seat **40**. This display can be a simple light display, e.g. a series of light emitting diodes (LEDs) or it can be a full video display. A preferred embodiment of the present invention provides a full video display to provide instructions and encouragement to a user of the stationary bicycle. For example, an image of a "virtual personal trainer" can be provided on the video display **56**. This image is preferably the image of the human personal trainer who is in charge of the remote system **14**.

The loudspeaker **58** provides another important communication medium to the user of the stationary bicycle **18**. For example, under computer **24** control, the user can be told

with either a digitally synthesized or digitally recorded voice to pedal faster, pedal slower, that they are doing a good job, etc. Of course, analog recording techniques can be used as well, but are considered to be less flexible and desirable. Preferably, the voice being used is that of the personal trainer associated with the remote system **14** that oversees that local system **12**. Both voice synthesis and digital voice recording on computer systems **24** are well known to those skilled in the art.

A local interface **60** can be used to couple the computer **24** to additional health and fitness devices. In this instance, the local interface **60** is coupled to the weight trainer **20** and to the scale **22**. This additional health and fitness systems can either "dumb" systems with limited digital computation and storage capabilities, or they can include full fledged computer system such as the computer system **24**. In the present embodiment, the weight trainer **20** and scale **22** include digital control circuitry (e.g. a microcontroller) which can communicate with the more powerful computer **24** of the stationary bicycle **18**. The various I/O devices, such as the loudspeaker **58** can be used in conjunction with these other devices **20** and **22**, e.g. the weight detected by the scale **22** can be announced on the loudspeaker **58** along with an indication that this is an increase or decrease in weight from the last session. Also, as mentioned previously, the weight trainer **20** can include the equivalent of the electrically controlled brake **52** which allows the resistance of the weight bar or handle to be varied to provide resistance ("weight") training. This control of the brake within the weight trainer **20** can be controlled by a "script" of the computer **24**.

The computer **24** is also coupled to a modem **62** for communication over a telephone line **30**. Alternatively, the computer **24** can be coupled to the remote computer **14** by other communication linkages, such as ISDN digital transmission line, via a local area network, or via a wide area network (WAN) such as the Internet. In other words, the telephone line **30** represents only one type of data communication channel between the local systems **12** and the remote system **14**. The Internet, which has been growing rapidly in popularity, is a particularly good communication linkage due to its ubiquitousness, power, and flexibility. As will be appreciated by those skilled in the art, the Internet is one form of distributed packet network where data is broken into packets which can travel along a multitude of paths between source and destination. The Internet (and private networks known as Intranets) are packet networks operating on the well-known TCP/IP protocols.

The present embodiment also includes a voice board **64** which can bypass the modem such that the loudspeaker **58** can be driven directly to the telephone line **30** in an analog fashion. Combination modem/voice boards are commercially available for personal computer systems, and are well known to those skilled in the art.

The remote system **14** includes, for example, a remote system computer **66** which is coupled to the telephone line **30** by a modem **68**. In addition, a telephone **70** can be coupled to the line **30** by a voice board **72**. Alternatively, the telephone **70** can be coupled to a separate telephone line so that simultaneous telephone and data links can be made. Still further alternatively, it is known to those skilled in the art that a single telephone line can be made to support both voice and data transmission. In any event, the telephone **70** can communicate directly with the loudspeaker **58** of the stationary bicycle **18** over the standard analog telephone line **30**. Alternatively, the telephone **70** can communicate with the computer **66** as indicated by the broken line **74** and the computer **66** can communicate digital voice data via modem **68**, telephone line **30** and modem **62**, to the computer **24**. The computer **24** can then store or pass through the digital voice data and play the voice input to the user of local station **12** via speaker **58**.

As noted above, the computer **66** is used to communicate with the local system **12** via computer communication link or "transmission medium" such as the telephone line **30** or an equivalent. This communication can include the downloading of data and instructions to the computer **24**, and can include the uploading of information from the computer **24** to the computer **66**. This allows for interactive communication between the remote system **14** and the local systems **12**.

The server stations **16** are used to further consolidate information from multiple remote system **14** and to provide a variety of services to the remote systems **14**. While the remote system **14** may be housed in human personal trainer homes or work sites, the server system(s) **16** are preferably more regional or national in origin. In this way, the main office of the enterprise can access each of the server systems **16** to provide upgrades for software, exercise programs, exercise equipment scripts, etc., as well as receiving information from the remote computers **66** that can be used for further analysis and for providing further services. Part of this analysis can be on the general and specific level of fitness of various individual users of the local system **12**, as well as marketing information that can be used to offer product and services particularly tailored for the various users of the local system **12**. The performance of the human personal trainers at remote stations **14** can also be monitored. It should be noted that the server **16** can include direct connect server **76** and peer server **78** that can either be direct server itself (like server **76**) to a number of remote stations **14**, or which can be a specialized server (such as a dietary analysis server) coupled to one or more direct connect servers **76**. In addition, higher-level servers can be used to further consolidate data from the direct connect servers **76** and/or the peer servers **78**. For example, the direct connect servers **76** can be regional in scope, while higher level servers can be national or international in scope.

In FIG. **2**, a computer **80** is shown in a block diagram form. This basic computer architecture can be used for the local system computer **24**, the remote system computer **66**, and the server system computer **76**. Of course other and equivalent architectures (in the computational sense), such as parallel processing computers can be used in the present invention as well. In the disclosed embodiment, the computer **80** includes a microprocessor **82**, random access memory (RAM) **84**, read only memory (ROM) **86**, real time clock (RTC) **87**, digital mass storage **88**, CD-ROM drive **89**, and a number of input/output (I/O) ports **90**. Preferably, the digital mass storage **88** is read/write memory such as a hard disk with adequate storage capacity (e.g. 40 megabytes to 2 gigabytes or more). In addition, CD-ROM drive **89** can be coupled to the bus to provide, in particular, images to be displayed on a display **56** of the local system **12**. The various components **82–90** address, pass data, and pass control signals through a bus **92** which typically includes data (D), address (A), and control (C) lines, as it is well known to those skilled in the art. In addition, there are control and "glue" chips typically provided in the form of a "chipset" which are used to couple the various components of the system together. The design and manufacture of computer systems such as computer system **80** is well known to those skilled in the art, and such computer systems are commercially available, both as complete systems and as subsystems (e.g. motherboards) from a variety of commercial sources.

In FIG. **3**, a process **94** implemented on a local system computer **24** is illustrated in a flow diagram. The process begins at **96** and, in a decision operation **98**, it is determined whether there is any activity which requires the attention local system computer. If not, the computer system **24** is in a "standby" mode and process control is returned to operation **98** in a recurring manner. If operation **98** does determine that there is some activity, one or more of multiple branches are made to process the activity. If the activity is "Exercise", e.g. the stationary bicycle **18**, the weight trainer **20**, or the scale **22** is to be used, an operation **100** processes the exercise activity. If it is a "Local System" activity such as routine housekeeping, the local system activity is processed in an operation **102**. If it is a "Remote System" activity, the remote system activity is processed in an operation **104**. After the completion of any one of steps **100**, **102**, and **104**, process control is returned to operation **98**. Of course, other types of activities can be initiated by operation **98** such as, for example, a shut down activity which would cause a power-down of system, as will be appreciated by those skilled in the art.

In FIG. **4**, operation **100** of FIG. **3** is illustrated in greater detail. The process **100** begins at operation **106** and, in an operation **108**, a "welcome greeting" is created. This welcome greeting can be displayed on the screen **56** and/or can be heard from the speaker **58**, and can be personalized to both the individual user of the local system **12** and the human personal trainer of remote station **14**. For example, the image of the personal trainer can show up on the screen **56** with his voice saying "Good morning, Fred! I haven't seen you since last Wednesday. Let's try to get in a good work-out today!" This greeting forms a part of a "virtual personal trainer" at local system **12** which replaces some or all of the need for a human personal trainer to be present at the exercise session at the local system **12**. The "virtual personal trainer" is, therefore, a computerized process which emulates part or all of the functions traditionally performed by a human personal trainer.

Next, in a selection operation **110**, the user decides whether he wants to select his own training program for that session or if he would like the system **12** to select the program. If the user selects the program, he creates a user "script" of what kind of exercise program he would like to perform that day. For example, if the user wishes to simply bicycle at a fixed resistance for thirty minutes, that can be entered in operation **112**. Alternatively, more complex "scripts" can indicate that he would like to bicycle with interval training for thirty minutes, and then do five repetitions on the weight trainer **20**.

If, however, the user allows the system **12** to select the section type, operation **114** controls the script selection. This is the preferred mode for using the local station **12** in that the script can be influenced not only by the local station **12**, but also by the human personal trainer at the remote system computer **66**. For example, data concerning the user's previous performances and the personal trainer's guidance can be stored in mass storage **88** (e.g. on a hard disk) so that a custom-tailored, interactive exercise program can be provided.

As noted above, the exercise program preferably proceeds according to "scripts." A script is simply a sequence of exercise or other health-related events that are performed in fixed or variable sequences. The order and structuring of the script can be modified based upon monitoring the user's performance or by other user feedback. For example, if it is detected that the user is getting tired due to a slowing of the exercise repetition rate, the operations or parameters of the exercise script can be modified accordingly. In other words, certain script steps can be skipped or the parameters concerning the steps can be modified. For example, if a user is determined to be tiring by the local system **12**, and if the script says the next exercise event is to be ten repetitions on the weight trainer **20**, that operation could be skipped. Alternatively, the weight training operation could still be done, but the resistance parameters could be modified. For example, instead of doing ten repetitions at a hundred pounds resistance on the weight trainer **20**, eight repetitions at eighty pounds of resistance might be called for. The script therefore provides a general framework of a desired exercise session which can be varied based upon human personal trainer input from remote system **14**, user input at local station **12**, and detected user performance at local station **12**.

Once the script has been initiated in either operations **112** or **114**, an operation **116** detects and records user activity and provides feedback to the user. This operation will be discussed in greater detail subsequently. Such parameters as the rotations per minute (RPM) of the crank **36**, the timing and speed of the resistance weight repetitions of weight trainer **20**, the detected weight on the scale **22**, etc. can all be recorded in the mass storage **88** of the local system computer **24**. In addition, user feedback is provided. For example, if the person is cycling too slow on the stationary bicycle **18**, the computer **24** can generate a encouragement on speaker **58** that the person should pedal faster. Alternatively, if it is determined that the user is over-exerting, such as pedaling too fast, a cautionary warning can be issued on speaker **58** to slow down. Another important input is the heart rate monitor (HRM) **59** which detects if the heart (pulse) rate is rising too high.

Next, in an operation **118**, it is determined whether the session is a modifiable session. Most sessions are preferably be modifiable, unless the user selects, in an operation **112**, a non-modifiable session. If the session is modifiable, the session is modified in an operation **120** based upon the selected script and upon user activity or other input. For example, if the heart rate monitor **59** detects that the pulse rate is too high, the resistance on the crank **36** can be reduced via a signal to the brake **52**. Next, in an operation **122**, it is determined whether the session is completed. This is usually based on the script, although the user can always terminate a session. If the session is not completed, process control is returned to operation **116** to repeat the loop. If the session is completed, the session records are updated in the mass storage **88**, as are the scripts, as indicated in operation **124**. The process **100** is then completed at operation **126**.

In FIG. **5**, the operation **116** of FIG. **4** is explained in greater detail. Process **116** begins at **128** and, in an operation **130**, exercise parameters relative to the script are stored, preferably in mass storage **88**. These parameters depend on the type of exercise being done, and the type of sensory input available to the system **12**, but typically includes such things as time, RPM, resistance, machine state, etc. These exercise parameters are used to control the implementation of the exercise script, and are stored for later analysis.

Next, in an operation **132**, it is determined whether encouragement is needed. An example of encouragement being needed is when the person is slowing down below the suggested repetition rate or speed in the script or, for example, has stopped exercising entirely. In such circumstances, encouragement is given in an operation **134**. Again, this encouragement can be auditory via speaker **58**, or visual via display **56**, a combination of the two, or in any other suitable fashion. Next, in an operation **136**, it is determined whether a caution is needed. If so, the caution is

given in an operation **138** either through auditory, visual, or other ways. Caution might be needed if the user is exercising faster than that suggested by the script or if a dangerous physical condition is detected, such as by the HRM **59**. Next, in an operation **140**, it is determined if a script preview should be provided. If yes, an operation **142** provides an auditory, visual or other type of preview of upcoming script events. For example, the system **12** could be taking a user on a imaginary bicycle ride through the country. The script preview would then, in an operation **142**, indicate something like "We are now approaching a hill. You will note an increased resistance to pedaling in a few seconds which will steadily increase until we reach the crest of the hill in about one and a half minutes." These operations **134**, **138**, and **142** are further examples of the local system **12** serving as a "virtual personal trainer." The process **116** is completed at operation **144**.

In FIG. **6**, operation **102** of FIG. **3** is illustrated in greater detail. Process **102** begins at operation **146** and, in an operation **148**, it is determined what type of local system activity is to be performed. Three different local system activities will be discussed herein by way of example. As a first example, the local system activity can be to alert the user as indicated in an operation **150**. For example, the local computer **24** can detect that it is time for a scheduled exercise session. The computer **24** can then communicate with the user via speaker **58** that it is time for a scheduled exercise. In this instance, the computer **24** would use a real time clock (RTC) **87** to know that it was time to initiate the exercise session. After completion of operation **150**, process control is returned to operation **148**.

A second type of local system activity would be housekeeping. For example, in an operation **152**, diagnostics can be run to check the operability and calibration of the various components of local system **12**. Also, in an operation **154**, data compression, hard disk compaction, and data preparation can be accomplished.

A third example of local system activity detected by operation **148** is a local communication within the local system **12**. For example, the weight trainer **20** or the scale unit **22** might be communicating to the computer **24** via the interface **60** or vice-versa. An operation **146** processes the data from the local unit accordingly and can provide commands to the local unit for the exercise or health session. Process control is then returned to operation **148** after the completion of operations **150**, **154**, and **156**.

In FIG. **7**, operation **104** of FIG. **3** is illustrated in greater detail. The process **104** begins at **158** and, in an operation **160**, the connection is established with the remote system. Next, in an operation **162**, information is uploaded or downloaded, the process is completed at **164**. It should be noted that the connection of operation **160** can be either an incoming connection or an outgoing connection. If there is an outgoing connection to a remote system computer **66** the modem **62** makes connection with the telephone line **30** and dials the telephone number of the remote system computer **66**. For an incoming connection, the modem **62** detects an incoming call on telephone line **30**, picks up the line, and connects to the local system computer **24**.

Since the systems **12** are typically home based, the user may wish to use a single telephone line for both normal telephone needs and for use by the system **12** for operation **160**. It would, of course, be simpler to have an additional telephone line installed simply for the system **12**, but this may be impractical from a cost point of view. If the system **12** is sharing the telephone line with the other telephones and devices in the household, mechanisms and/or processes are preferably provided to prevent interference with normal telephone usage. If the local system **12** initiates the call to the server **66**, it would simply need to detect whether the telephone line was available so as not to interfere with other use of the telephone line. It can help ensure this availability by calling at unusual times, such as the middle of the night or when it is known that the user is away from the home, e.g. at work.

However, with incoming calls from a computer **66** to the computer **24** on a single home line, some way of distinguishing between calls for the local system **12** and other kinds of telephone calls should be preferably provided. Again, this could be time-based such that it is implied that a telephone call in the middle of the night is for the local system **12**. The RTC **87** could be used for timing purposes in this situation, or the computer could simple start a counter. In this instance, the modem **62** would pick up the telephone quickly before other devices, such an answering machine for a facsimile machine, would have a chance to pick it up. Alternatively, the local system **12** could allow a number of "rings" before picking up the line. For example, the local system **12** could allow the telephone line **30** to ring six times before modem **62** picks up the line. In a still further instance, the computer **66** might be calling a local computer **24** and have the phone line picked up by the user or by another device (like a telephone answering machine) coupled to the telephone line **30**. In this instance, the computer **66** could hang up the line and call back a second time. Since the computer **24** can monitor the line via modem **62**, it could know that a call back within, for example, thirty seconds of a hang up is for the computer **24**. Alternatively, it could listen to the line on the first call to determine if it was computer **66** calling, and then pick it up the line **62** immediately on any call back, or call back the remote system computer **66** itself when the telephone line was free. Again, RTC **87** can be used for timing purposes, or counters can be used, as is well known to those skilled in the art.

Information being uploaded can include parameters and data stored in the mass storage **88** concerning the exercise sessions by the user(s) of the local system **12**. It can also include other system information used for diagnosing or improving the operation of the local system **12**. In addition, information can be downloaded to the local system **12** from the remote system computer **66** to, for example, change exercise scripts for a user, provide upgrades for the software running on the local system computer **24**, etc.

In FIG. **8**, a process **166** running on a remote system computer **66** is illustrated. The process **166** begins at **168** and, in an operation **170**, an activity type is determined. A first type of activity is a batch system connection whereby the remote system computer **66** sequentially connects with a series of local systems for the uploading or downloading of information. This process is accomplished in operation **172**. A batch system connection can be used to update the software on a number of computers **24** of local system **12**, or to upload exercise session data from a number of local systems **12** on a regular basis, e.g. daily, weekly, monthly, etc.

If operation **170** detects a single system activity type, an operation **174** connects the remote system computer **66** to a single local system **12** for uploading and/or downloading as described previously. If an activity type "Process Data" is detected by operation **170**, an operation **176** prepares data on the computer **66** for storage, processing, communication, and/or analysis. Examples of some types of analysis of the data will be discussed subsequently with referenced to

FIGS. **8***a*–**8***c*. Finally, if an activity type "Server Connection" is detected, a connection is made with the server **76** to upload or download information. The server connection can be initiated by the computer **66**, or it can be initiated by the server system computer **76** depending on the circumstances. Upon the completion of any of the operations **172**, **174**, **176**, and **178**, process control is returned to operation **170**.

In FIGS. **8***a*–**8***c*, several examples of types of data analysis that can be performed on the remote system computer **66** in operation **176** of process **166** are illustrated. Of course, this analysis can be accomplished at any of the computers on the system **10** including the remote system computer **66**, server system computer **76**, peer system computer **78**, or even on the local system computer **24**. In FIG. **8***a*, a display of exercise activity is shown. This display can be on the display on a video display, such as a display **56**, or it can be printed to make a permanent record. Along the y axis are the number of minutes of exercise, and along the x axis are the days of the week. As seen in the illustration of FIG. **8***a*, on Monday the user had twenty minutes of exercise, on Tuesday the user had sixty minutes of exercise, and on Thursday the user again had twenty minutes of exercise.

In FIG. **8***b*, another display or print out of, preferably, the remote system computer **66** is a summary of daily exercise activity. As noted, the Monday twenty minute exercise session actually consisted of a ten minute cycling session and a ten minute weight session. Also includes is a summary of the number of calories burned and other parameters associated with those activities.

In FIG. **8***c*, a plot of the user's weight as taken from scale **22** is shown illustrating the day-by-day weights of the user during part of the month of January. In this way, users are provided with good feed-back concerning the progress he/she is making in reaching their ideal weight. This information can be used by the remote or server systems to modify the exercise scripts and/or provide dietary counseling or products to the individual users of local stations **12**.

As noted, the analysis of the data is preferably accomplished at the site of the human personal trainer, i.e. the site of the remote system computer **66**. However, this analysis can also be accomplished at upstream or downstream computers. As mentioned previously, the computer **24** of the local system **12** is perfectly capable of making these types of analysis and displaying the on the display **66**. Also, a simple printer I/O port can be provided in the stationary bicycle **18** to allow a printout of the graphs and charts that were shown by way of example in FIGS. **8***a*, **8***b*, and **8***c*.

In FIG. **9**, a process **180** running on server system computer **76** is illustrated. In many ways, the process **180** running on the server system computer **76** is very similar to the process **166** running on the remote system computer **66**. The process **180** begins at **182** and, in an operation **184**, an activity type is detected. One type of activity type is the batch connection where the server sequentially (e.g. serially and/or in parallel) connects to a series of remote system computers **66** for uploading and downloading information. This process is accomplished at operation **186**. Another activity type detected by operation **184** is the single system connection accomplished in operation **188**. In operation **188**, the server connects to a single remote system for uploading or downloading. In the case of operation **186** where there is a batch connection, the server system computer **76** will almost always be the initiating computer for the connection. With the single system connection however, the initiation of the connection can come either from the server **76** or from the remote system computer **66**.

If operation **184** detects a "Process Data" activity type, the data for multiple remote system computers **66** (which includes data from multiple local system **12**) is prepared for storage, processing, communication, and/or analysis in an operation **190**. If an operation **184** determines that there is to be a peer-to-peer connection with a peer server **188**, an operation **192** makes the connection with the peer server to pass data back and forth. Of course, there are other activity types that can be performed by the process on server system computer **76**, these four being by way of example. After the completion of operations **186**, **188**, **190**, or **192**, process control is returned to operation **184** to detect another activity type.

In FIG. **10**, an Internet linked version of the present invention is illustrated. Those portions of the system that are similar to those previously described use the same reference numbers. It should be understood that while this embodiment is described in terms of the Internet, is also applicable to other forms of networking. However, a data packet network such as the Internet, or an Intranet, operating on a TCP/IP protocol is preferred.

In FIG. **10**, a local system **12***a* is provided with an Internet access apparatus **196**, and an enlarged video display such as a television **198**. The television **198** can be any standard television (currently typically an analog television) which can develop an image provided over a cable or wire **200** from the Internet access apparatus **196**. Internet access apparatus such as apparatus **196** are available from variety of vendors at the present time, and are generally referred to as a "set-top Internet boxes." Set-top Internet box **196** typically communicates with a user via Infrared (I/R) data linkages, such as I/R linkages **202** and **204**. In the present invention, these linkages are used to communicate with the local system **12***a*, as will be appreciated by those skilled in the art. Some optimization of the software in the apparatus **196** may be preferable to communicate with the local system **12***a*, although standard apparatus **196** can also be used by having the local system **12***a* emulate a remote I/R unit or remote I/R keyboard.

Local system **12***a* includes an I/R transmitter **206** which produces an I/R beam **202** that can be detected by an I/R detector **208** of the Internet access apparatus **196**. The local system **12***a* also includes an I/R receiver **210** which receives an I/R beam **204** generated by an I/R transmitter **212** of the Internet access apparatus **196**. Techniques for communicating between electronic devices with I/R beams are well-known to those skilled in the art.

If a higher-bandwidth linkage or "link" is preferred between the local system **12***a* and the Internet access apparatus **196**, a cable or the like can be provided to connect the two. Also, it will be appreciated by those skilled in the art that the Internet apparatus **196** is only one method for accessing the Internet, other methods including the use of personal computers, etc. Higher-bandwidth is likely to be desired if a video camera **214** is used to transmit video over the Internet.

The Internet access apparatus can be coupled to the Internet **216** by a number of communication linkages or "transmission media." For example, if the Internet access apparatus **196** includes a cable modem, a cable **217** can be coupled to an Internet server at a cable provider **218** to couple to the Internet **216**. Alternatively, if the Internet access apparatus is provided with a standard modem, a telephone line **220** can be coupled to a Internet server at a telephone provider **222** to couple to the Internet **216**. Finally, if a wireless modem is provided by Internet access apparatus

196 with an antenna 224, an Internet server at a wireless provider 226 with an antenna 228 can be used to couple to the Internet 216.

Also coupled to the Internet 216 are one or more local systems, such as local systems 12*b* and 12*c*, one or more remote systems 66', and/or one or more server systems 76'. Since the local, remote, and server systems are all coupled to the Internet 216, their hierarchy is more a logical hierarchy rather than a physical or wired hierarchy. In other words, the local systems can talk with each other and with the remote system 66, and the remote systems can talk with each other and with the server system 76 in a "logical hierarchy."

In FIG. 11, a computer system 24 ("local computer") of local system 12*a* is illustrated in greater detail. As previously described, the local computer 24 can comprise the motherboard of a standard personal computer that has been programmed to perform the process of the present invention. Most of these processes have already been described, and will not be repeated here. The computer 24 is operative to control the I/R transmitter 206 and the I/R detector or receiver 210 to implement communication with the Internet access apparatus 196. As mentioned previously, these communication linkages can be augmented or substituted by other types of communication linkages, such as a higher-bandwidth cable or twisted pair linkage to the Internet access apparatus 196. In addition, the computer 24 can receive video data from a video camera 214 of the user. This video data can either be real time data, or a series of video "snapshots," e.g. a "frame" a video sent every few seconds. Preferably, if this video data is to be sent over the Internet, it is compressed by some form of standard compression algorithm, such as MPEG.

Also shown in FIG. 11 are a number of "active" actuators 220, 222, 224, and 226. These actuators are controlled by computer 24. Actuator 230 is coupled to the crank 36 of the pedal 38 to provide a tactile, haptic, or "force" feedback on the pedal 38. Likewise, actuators 232, 234, and 236 are provided to provide a tactile, haptic or "force" feedback on the stem 42 of seat 40, on the stem 46 of handlebar 44, and on the frame or enclosure 34 itself. Therefore, "real-world" forces such as hitting a rock, wind forces (which tend to exert the force on the handlebar 44) and others can be imparted on the user of the local system 12*a*.

The actuators 230–236 can be motors, solenoids, and other forms of forceproducing mechanisms. They can be electrically, hydraulically, or pneumatically controlled, although electrically controlled actuators are preferred. It should also be noted that the actuators can also serve as sensors that can be "read" by the computer 24. Also, the actuators can be used to provide mechanical resistance. For example, the actuator 230 can eliminate the need for a friction-type brake 52. Also, the actuator 234, if of a suitable type, can be used to both sense the position of the handlebar 44 and to provide a force feedback on those handlebars.

In FIG. 12, a "virtual exercise session" in a "virtual world" is illustrated. More particularly, an image I is developed on the screen 238 of the television 198 which simulates both the user 240 and one or more individuals 242. These one or more other individuals can be users at other local machines, or can be the "personal trainer" at another local system or at a remote system. In this instance, the user is riding a bicycle along a road 244 and is trailing behind the other user 242 also riding a bicycle. Through the use of the actuators, the user 240 can feel the surface of the road, can get a "boost" when going downhill and feel a "drag" as he goes uphill, can feel the affects of a wind 246, can feel the lessening of resistance to pedaling when "drafting," i.e. riding closely behind, the other user 242, etc. With the use of the video camera 214, an image of the other user 242 can be provided on the screen 238, e.g. pasted onto the cycling figure's body 242, as can be the image of the user 240 on the screen of the local system of user 242.

Of course, there are many "virtual worlds" that one or more users of the exercise apparatus can inhabit. For example, the user can be a standard gymnasium or health club, and wander from exercise equipment to exercise equipment while interacting with other user/exercisers and personal trainers in this virtual world. In consequence, the user 240 is motivated to exercise in much the same way as if he journeyed to a gymnasium or health club, without leaving the comfort and convenience of home.

FIG. 13 illustrates a remote interactive exercise and health system 250 in accordance with a preferred embodiment of the invention. This embodiment, as was the case with the previous embodiments, may be implemented over a wide area network (WAN) such as the Internet 252. The remote interactive exercise and health system 250 preferably includes a number of fixed local systems 254A–254N and one or more mobile local systems 256A–256N. The system 250 also preferably includes a remote server 258 which can include one or more physical or "virtual" servers 260A–260N. The system 250 also includes one or more trainer machines 262A–262N.

A fixed local system, such as fixed local system 254A, typically includes one or more health and/or exercise devices (often referred to herein as simply "exercise devices", "exercise apparatus", etc.) such as exercise devices 264A–264N. These one or more exercise devices 264A–264N are associated with a fixed local server 266. Of course, additional fixed local servers can be implemented as will be appreciated by those skilled in the art. The exercise devices 264A–264N can be of a variety of types such as stationary bicycles, weight lifting machines, operation machines, treadmills, scales, etc. As a minimum, the exercise devices 264A–264N should include at least one sensor which permits data to be processed and sent to the remote server system 258 via the Internet 252. The exercise devices can also include passive devices such as scales, heart rate monitors, etc., which typically have an output dependent upon one or more sensors. It is preferable, but not essential, that the exercise device 264A–264N includes some type of feedback or actuator which mechanically influence the exercise device to vary the resistance, provide tactile feedback, provide haptic feedback, etc., to a user.

Typically associated with an exercise device is a user such as user 266A–266N. The users 266A–266N interact with the system 250 at least through the exercise devices 264A and 264N. Such interaction will be referred to herein as "in-band" interaction. However, the users 266A–266N can also interact with system 250 through "out-of-band" interactions 268A–268B. As will be discussed in greater detail subsequently, these "out-of-band" interactions do not necessarily go through the Internet 252. For example, a user 266A may be interacting with the fixed local server 266A on a separate, high speed data connection to provide real time video information to the exercise device 264A. Alternatively, the out-of-band interaction 268A could be a cellular phone conversation with a personal trainer.

Of course, out-of-band interaction can also be performed in-band. In a preferred embodiment of the present invention, an inexpensive controller and interface providing low-data rate "in-band" transfers for an exercise device is seen to be

preferable. Such a controller will add only minimally to the cost of the exercise device (which typically needs a controller anyway), permitting manufacturers to provide the "in-band" compatibility on virtually their entire product line. This "in-band" transfer is primarily a transfer of sensor data (from the exercise device) and scripts and other data to the exercise device. Other, high bandwidth transfers, such as streaming video and audio, etc., can be accomplished with an add-on "out of band" device. For example, a head mounted display and earphones can provide an out of band experience. Nonetheless, other embodiments of the present invention utilizes a single, high-speed channel, such as an 802.11 protocol channel, to couple the exercise device to the rest of the system. Of course, this would require a much more complex controller, approaching the complexity of a personal computer, to be provided for the exercise device. If a suitably powerful controller were provided in the exercise device, then all data transfers could be "in-band."

Similarly, the mobile local systems **256**A–**256**N typically include mobile exercise devices **270**A–**270**N and mobile local servers **272**A–**272**N. In this instance, there is usually a one-to-one correspondence between a mobile exercise device **270**A and a mobile local server **272**A. However, in alternate embodiments of the present invention, two or more exercise device **270**A may be associated with a single mobile local server **272**A by, for example, wireless connection. Often, the mobile exercise devices **270**A include one or more sensors, such as an RPM sensor, a GPS sensor, an elevation sensor, an energy expended (wattage) sensor, a pulse rate sensor, an oxygen saturation sensor, etc. The mobile exercise devices **278**A are typically not provided with actuators, although it is possible to do so. For example, a mobile bicycle can be provided with an actuator which would shift gears on the bicycle. Nonetheless, other feedback can be provided to a user of mobile exercise equipment **270**A through the "in-band" and/or "out of band" connection, such as current location, advice from the trainer, etc., via, for example, a display on a bicycle computer. Again, associated with each of the mobile exercise devices **27**A–**27**N are one or more users **274**A–**274**N. These users can interact with the system **250** by the "in-band" experience and/or by an out-ofband experience **276**A–**276**N. Again, these out-of-band experiences can be high speed data connections to the local mobile computer or true out-of-band experiences such as a cellular telephone conversation with the trainer.

The remote server **258** is in an at least part time communication with the local systems **254**A–**254**N and mobile systems **256**A–**256**N. As will be appreciated by those skilled in the art, the remote server system **258** can include one or more physical and/or virtual servers **260**A–**260**N. This permits the easy scalability of the system **250** as more users and trainers use the system. Typically, the remote server system **258** is the intermediary for communication between local systems and trainer machines, but in alternate embodiments of the present invention, local servers may communicate directly with each other or through the Internet **252** or directly to a trainer machine through the Internet **252** or other transmission media, as will be appreciated by those skilled in the art.

The trainer machines **262**A–**262**N are typically associated with individual trainers **276**A–**276**N. The trainers may interact with the system **250** through in-band communication or may communicate with, for example, users **266**A–**266**N and **274**A–**274**N through out-of-band communication **278**A–**278**N. Such out-of-band communication can be, as explained previously, cellular or telephonic communication with one or more users. Alternatively, streaming video and/or audio, video files, audio files, graphics, etc. can be provided to the user and/or the trainer through an in-band or out of band communications link. The trainer machines **262**A–**262**N are preferably personal computer systems using the Microsoft Windows or Mackintosh operating systems, for example, and provided with a display screen, keyboard, and pointing device such as a mouse. Preferably, the interface between the trainers **276**A–**276**N is a World Wide Web (WWW) type interface. For example, a web browser such as Microsoft Explorer™ or Netscape Navigator™ can be used on the trainer machines **262**A–**262**N to access a secure website on the remote server system **258**, as will be explained in greater detail subsequently.

The present system is well suited for franchise and multi-level marketing systems. Trainers can buy a franchise, or operated as an independent contractor, and sell memberships to users. A user can then either buy or lease a local system, along with the service provided by the trainer. As trainers obtain too many clients for them to personally manage, they can create sub-franchiser or sub-contractor trainers for some of the clients. The top level trainers will not only obtain compensation for each of their direct clients, but they will also obtain a smaller share of the compensation for their indirect clients through the sub-franchiser or sub-contractors. Trainers can also be sponsored, e.g. by a company for its employees.

FIG. **14** is a block diagram of an exercise device circuit which can be associated with, for example, an exercise device **264**A–**264**N or **270**A–**270**N. More particularly, an exercise device controller **280** includes an interface controller **282**, a sensor **284**, and a transmitter **286**. By "transmitter" **286**, it is meant that the appropriate drivers are provided to create a signal **288** which can be transmitted to a local server via wired, optical, wireless, or other transmission media. The sensors **284** are preferably coupled to a resistance mechanism or actuator **290**. The interface controller preferably also includes a device ID **292**, a user ID **294**, switches and keyboard **296**, and a display **298**, such as a flat panel display. The controller **280** can also optionally include an actuator **300** and a receiver **302**. The receiver **302**, like the transmitter **286**, can receive a signal **304** via a variety of transmission media including wired, wireless, optical, fiber optic, etc.

A reason for "in-band" base functionality is to make the basic controller ubiquitous to exercise equipment. By making the base functionality whereby interaction with the sensors and actuators of the exercise equipment is supported, but not necessarily high-bandwidth interactions, the controller can be made very inexpensively and put into almost any exercise device with electronic circuitry. The more expensive circuitry for high-bandwidth interactions can be provided separately with the "out of band" capabilities of the present invention.

The interface controller **282** is preferably an integrated microcontroller having microprocessor, RAM, EPROM, and various interfaces. Alternatively, the interface controller can be implemented with discrete components. The purpose of the interface controller is twofold, namely to interact with the sensor and/or actuator of an exercise device and to provide communication interfaces to a user and to other portions of the remote interactive system **250**. It is desirable that the interface controller be relatively low cost so they can be added to each piece of manufactured exercise device such that the interface become ubiquitous.

In addition to communicating with sensor **284** and actuator **300**, the interface controller **282** can provide a display on

display **298** to enhance the exercise session for the user. The display can provide internally developed parameters such as RPM (in the example of a stationary bicycle), it can also display information provided by, for example, the trainer via the system **250**. The keyboard **296** is used to input various user commands into the system.

Preferably, each exercise device is provided with a device ID **292**. This identifies the particular device to the system **250**. In one preferred embodiment, the device ID is stored in an EPROM internal to the interface controller **282**. In other embodiments of the present invention, the device ID can be provided by dip switches or other coding mechanisms that can be read by the interface controller **282**.

Also preferably, each user is provided with a user ID **294**. This permits a user to use any piece of compatible equipment by entering his or her user ID, such that the system **250** knows that he or she is using that exercise device. The user ID can be provided through the keyboard **296**, or can be provided in the form of a physical key that can attach, for example, to a keychain. Magnetic keys which can store a user ID **294** are well known to those skilled in the art.

Communications between the interface controller and the rest of the system **250** through the transmitter **286** and the optional receiver **302** comprise "in-band" communication. However, there can also be out-of-band communication signals **304** between the controller **280** and, for example, a local server **266**A. These "out-of-band" signals can include, for example, high speed data communication to provide real time video (e.g. streaming video over the Internet) on the display **298**.

FIG. **15** is a block diagram of an exemplary interface controller **282** of this invention. The interface controller **282** preferably includes a system bus **306** which interconnects a number of components such as a microprocessor **308**, an EPROM **310**, RAM **312**, and a number of interfaces **314**–**322**. Optionally, the interface controller **282** can include a system ID interface **324** and a clock/counter **326**, both of which would also be coupled to bus **306**.

In certain embodiments, it is preferable that as many as the components of controller **282** as is possible are integrated into a single device. For example, the microprocessor, RAM, and EPROM, as well as a number of the I/O devices, can be integrated into a single chip. The EPROM can be EEPROM which allows the electrical reprogramming of the EPROM. Alternatively, the controller **282** can be made from discrete devices.

The EPROM **310** includes the program instructions for the controller **282**. These program instructions will be described in greater detail with reference to FIGS. **16**, **17**, **18** and **19**. Also, preferably, this system or device ID can be stored in the EPROM **310** during factory installation. The RAM **312** is used as "scratch pad" memory by the microprocessor and can serve as a buffer for the various I/O devices. The EPROM **310** and the RAM **312** comprise the primary memory for the controller **282** which may have a memory map as indicated at **328**. In this exemplary illustration, interface programming, encryption algorithms, system ID, and scripts are mapped into memory locations ranging from low (LO) memory to high (HI) memory.

The various input/out (I/O) devices include a user ID interface **314**, a sensor interface **316**, an actuator interface **318**, a keyboard interface **320**, and a display interface **322**. The primary direction of data flow is indicated by the arrow to each of these I/O devices. That is, the user ID interface provides user ID information to the system **282**, and is therefore primarily an input device. Likewise, sensor interface **316** and the keyboard interface **320** primarily provide information to the system **282** and therefore are also input devices. The actuator interface **318** and the display interface **322** "display" will provide outputs from the controller **282** and, therefore, are primarily output devices. As will be appreciated by those skilled in the art, input devices include analog-to-digital circuitry (A/D), while output devices include digital-to-analog (D/A) circuitry.

As noted above, a preferred embodiment of the invention stores the system ID in the EPROM **312**. However, it may also be desirable to have a system ID provided externally to the controller **282** via system or device ID interface **324**. This would more securely couple the device ID to the physical device, such that the controller **282** or EPROM could not be removed and placed on another exercise device. Also shown is an optional clock and counter, which in a certain embodiments is a real time clock. The clock/counter **326** is used to time various intervals, such as sleep mode, pulling schedules, etc.

FIG. **16** illustrates part of the interface programming stored in the EPROM **310** of FIG. **15**. More particularly, a process **329** is implemented on the controller **282** which begins at **330** and, in an operation **332**, the process initializes the hardware. As will be appreciated by those skilled in the art, this involves the writing to certain registers and the initialization of counters and other variables in the controller **282**. Next, in an operation **334**, it is determined whether the hardware is operating correctly. This is typically accomplished under microprocessor **308** control wherein data is written to and read from memory and various buffers, and wherein commands are sent to the various I/O devices to see if they operate correctly. If the hardware check is not okay, an error is displayed in operation **336**, preferably on the display **298** of the exercise device controller **280**. The process then ends at **338**. However, if the hardware is determined to be functional, an operation **340** reads the system ID. Next, in operation **342**, the controller **282** of an exercise device, for example **264**A, attempts to connect with a local server, such as server **266**A. If it does not successfully connect with the server, a "local mode" flag is set to indicate that there is no server connection. If the controller **282** does connect with the server, an operation **246** determines whether the server is on the Internet. If the server (such as a server **266**A or **272**A) is not connected to the Internet, an operation **348** sets the server mode flag to indicate the server is not on the Internet. If operation **346** determines that the server is on the Internet, an operation **350** sets an Internet mode flag.

Next, an operation **352** determines if there is a user ID. The invention can work in either an user identified mode, or in an unanimous mode. If there is no user ID as determined by operation **352**, an operation **354** sets an anonymous mode flag. If there is a user ID, an operation **356** reads the user ID for use by the system. Finally, the exercise session is run in an operation **358** and the process ends at **338**.

In FIG. **17**, the process "Connect with Server?" **342** of FIG. **16** is illustrated in greater detail. Process **342** begins at **360** and, in operation **362**, the start time is obtained and stored. Next, in operation **364**, it is determined whether a "ping" is received from the server. By "ping" it is meant that a message is sent from the server and addressed to the exercise device having the primary purpose of determining whether the exercise device is active or "alive." If operation **364** does not receive a ping from the server, the current time is obtained in operation **366** from, for example, the real time clock **226**, and an operation determines whether the difference between the current time and the start time is greater than a constant K. If it is, the process **342** has "timed out" and the operation is complete at **370**.

If a ping has been received from the server as determined by operation **364**, an operation **372** performs a key exchange with the server. As will be appreciated by those skilled in the art, this key exchange should be secure using one of several well known key exchange algorithms. For example, the well-known Diffie-Hellman algorithm is suitable. In one embodiment, the server can encrypt its key with a first encryption code, send it to the exercise device which then adds its own key and encrypts the entire package with its own encryption. The doublyencrypted packet is then sent back to the server which decrypts with its encryption code, removing its own key and encrypting the encrypted packet including the key of the exercise device. The encrypted packet is then sent back to the exercise device to remove its encryption and, finally, the encrypted packet is then sent back to the server where it is decrypted by the server to remove the exercise devices key. Thus, by using multiple transmissions, the keys can be securely exchanged without broadcasting any unencrypted data.

Process **342** continues at operation **374** where it is determined whether the key exchange was successful. If it was successful, a connect flag is set to true in an operation **376** and the process **342** is completed at **370**. Otherwise, the connection flag is set to false in operation **378**, and the process is likewise completed.

In FIG. **18**, the process "run exercise session" **358** of FIG. **16** is illustrated in greater detail. The operation **358** begins at **380** and, in an operation **382**, a default script is loaded. Next, in an operation **384**, it is determined whether there is a script change command. These script change commands are preferably (but not necessarily) of at least three different types. A first type of script change command is a user script change command which is implemented in an operation **386**. A second type of script change command is a server script change command which is implemented in an operation **388**. A third type of script change command is an Internet script change command which is implemented in an operation **390**.

After the implementation of one of the script change commands in operations **386**, **388**, or **390**, or in the absence of a script change command, an operation **392** executes the script on the exercise device for an interval of time. An operation **394** determines whether the process is done, and, if not, process control is returned to operation **384** to look for additional script change commands. Otherwise, the process is completed at **396**.

As used herein, a "script" is a sequence of data or commands which can be used to influence the operation of the exercise equipment. Therefore, a script can be a computer program, such as a Java Applet, or it can be a proprietary script language which is interpreted by the controller of the exercise equipment, or it can be a string of data or parameters, (e.g., duration, level, scaling, etc.), that is acted upon by the controller to influence the operation or use of the exercise device. It will therefore be appreciated that the term "script" broadly encompasses the locally executed functionality in the exercise equipment controller to influence the operation of the exercise device. Of course, as will be appreciated by those skilled in the art, portions of the "script" can be distributed, for example, to the local server or, via the Internet, to one or more systems, sensors, or machines connected to the Internet.

FIG. **19** is a flow diagram illustrating the "executed script" operation **392** of FIG. **18** in greater detail. Operation **392** begins at **398** and, in an operation **400**, the script is read according to a time interval Δt. In an operation **402**, any actuator is sent its command, and in an operation **404**, any sensor data is read. As will be appreciated by those skilled in the art, an actuator command is typically accomplished by placing data in an output buffer of the actuator interface which is then converted by D/A converters to analog signals which can control the actuator. As will also be appreciated by those skilled in the art, the reading of sensor data is typically accomplished by reading a sensor data buffer in the sensor interface which was produced by taking analog signals produced by the sensor and digitizing them with a A/D converter. The sensor and parameter data are stored in an operation **406** for later reference and processing. This data can typically be stored in buffers provided in the RAM Memory **312**.

Next, an operation **408** determines whether there is an Internet mode flag or a server mode flag. If so, the sensor data is buffered in operation **410**. An operation **412** then determines whether there is a call from the server and, if so, the sensor buffer is sent to the server in an operation **414**. If there is no Internet mode flag or server mode flag or after the completion of operations **412** and **414**, an operation **416** determines whether it is time to create an update. If so, an operation **418** updates the session parameters and the display. That is to say, the session parameters are updated in a memory store, such as RAM **312**, and a display is provided such as on display **322**. Process control then returns to operation **400**. The process **392** continues to operate until an interval of time has elapsed at which time operation **392** ceases and operation **394** on FIG. **18** takes process control.

In FIG. **20**, a fixed local server **266**A is graphically illustrated. In this embodiment, the server **266**A sits on a floor **420** between an electrical outlet **422** and a telephone outlet **424**, both of which are provided in a portion of a wall **426**. In this embodiment, the server **266**A is provided with an external power supply **428**, which also sits on the floor **420**. The supply power **428** has a cord **430** which plugs into one of the sockets of electrical outlet **422** and has another cord **432** to provide DC power to the server **266**A.

The server **266**A is preferably provided with an antenna **432**, a reset button **434**, a number of exercise device connection sockets **436**, and an Internet connection socket **438**. In a preferred embodiment of the invention, the server **266**A communicates with the exercise devices wirelessly through radio transmission emanating from antenna **432**, for example. In a wireless system, the transmitter **286** and receiver **302** of controller **280** in FIG. **14** are radio frequency transmitters and receivers. Alternatively, the server can communicate with the exercise devices by other wireless communication forms, such as infrared communication. Still further, the server can communicate with the exercise devices via a hard wire, coaxial cable, fiber optic cable, etc., connection through one of the exercise device connection sockets **436**. Likewise, while the server **266**A is shown to be coupled to the telephone outlet **424** by a telephone cable **440**, the server **266**A could also make an Internet connection through wireless devices, such as a radio modem. Further, while the outlet **424** is described as a "telephone" outlet, it will be appreciated that it also represents other hard wire and/or wireless connections to the Internet including DSL, T1 lines, fractional T1 lines, etc. That is, the telephone outlet **424** represents either an analog or digital signal connection between the outlet and the Internet which could actually be implemented by a number of different protocols.

In certain embodiments of the present invention, the human-computer interface of the local server is kept as simple as possible. For example, one embodiment of the invention the server has only a reset button as an interface. This makes the server "appliance-like" and therefore very easy to use. In other embodiments of the present invention,

more complex human-computer interfaces such as a touch-screen display providing a menu of options can be provided. The wireless embodiments of the present invention also help in the appliance-like nature of the local system, as well as its scalability. For example, a new exercise device can be added to a local system by simply bringing it into proximity to the local server and hitting the reset button of the local server, and an exercise device can be removed from the local system in a similarly easy fashion. One exercise device or many exercise devices can be associated with a local server in a very scalable manner. Further, many local servers, trainer machines, and remote servers can be added to the system in a scalable fashion.

In FIG. **21**, the server **226**A includes a typical computer architecture including a bus **442** to which is a coupled a microprocessor **444**, random access memory (RAM) **446**, read only memory (ROM) **448**, as well as a number of peripherals **434**, **450** and **452**. The microprocessor **444**, RAM **446**, and ROM **448** are relatively center components and they are available from a variety of manufacturers. However, it is preferable to have the microprocessor **444** be an Intel compatible Pentium class processor so that it can run standard operating instrument systems such as the Linux operating system. Preferably, a journaling file system such as Reiser FS would be used so that the integrity of the file system would be preserved in the event of a sudden power failure. For simplicity, the RAM **446** should be static RAM (SRAM) and the ROM **448**, depending on the implementation, may be an EPROM.

The reset button **34** is coupled to the bus **442** by appropriate interface circuitry such that a reset command can be sent to the microprocessor **444**. An in-band transceiver **450** is coupled to the bus **442** to send and receive electromagnetic radiation (radio signals) via the antenna **432**. The in-band transceiver **450** communicates with the in-band transmitter **286** and the in-band receiver **302** of **614**. The network connection **452** couples the bus to the Internet socket **438**. Depending on the type of Internet connection, the network connection **452** may take a variety of forms. For example, the network connection **452** can be a modem and the Internet connection is by regular telephone line. Alternatively, the network connection can be an Ethernet connection for connection to a digital line such as a DSL or T1 line. As is well known by those skilled in the art, the network connection is configured for the appropriate connection type.

In an expanded version of the server **226**A, there is also provided a mass storage device such as a hard disk drive **454**, a graphics accelerator **456**, and an out-of-band transceiver **458**. The addition of an hard disk drive is desirable and then it supports standard operating systems such as the Linux operating systems. Of course, other operating systems could be supported such as Windows NT, Unix, etc. However, the Linux operating system is particularly well suited for this application since it is inexpensive (free), easily configurable, and well suited for Internet connection applications. The hard disk drive can also serve as a local store for scripts, programs, commands, buffered items, graphics, video and audio informations, etc. The graphics accelerator **456** is useful for graphically driven outputs which, in a preferred embodiment, would be sent to a user by an out-of-band transceiver **458**. For example, the user could use a wireless, headmounted display with display screens in front of each of his or her eyes as well as ear phones. This type of information is of too high of a bandwidth for the preferred, low bandwidth in-band transceiver **450**, but could be handled by an out-of-band transceiver **458** transmitting on an antenna **460**. By providing this form of out-of-band communication, high quality and stereo video information could be sent to a user, as well as high fidelity and stereo audio information. This information can be viewed on a television screen, a computer monitor, a head-mounted display, a display associated with the exercise device, etc., by way of the out-of-band transceiver. While the out-of-band transceiver is shown to be wireless in this embodiment, it will be appreciated by those skilled in the art that the out-of-band transceiver can also be a wired transceiver such that connection media such as electrical wire, coaxial cable, fiber optic, etc., can be used. Further, other forms of wireless transmission and reception can be used with the out-of-band transceiver **458** as well, including, but not limited to, I/R transmission and/or reception. Of course, all communication can be "in band" if the investment is made in the hardware necessary to support high-bandwidth communication. For example, the exercise equipment controller can include sufficient processing and peripheral power to utilize 802.11 wireless interconnections, which would provide enough bandwidth for completely "in-band" communications in certain embodiments of the invention.

FIG. **22** illustrates the server operating system **462** which is implemented on the server **226**A. The operating system begins at **464** with power on and, in an operation **466**, the operating system is booted. As mentioned previously, a preferred operating system is Linux, which is a public domain operating system. Preferably, the Linux is provided with Reiser FS to prevent power up and power down glitches. The booting of an operating system, including Linux with Reiser FS, is well known to those skilled in the art. Next, in an operation **468**, one or more daemons are executed. In this example, two daemons are run including Cybergym Daemon A and Cybergym Daemon B. As well known to those skilled in the art, a daemon is a process which runs substantially without interaction with the end user. An operation **470** determines whether there has been a reset based upon the pressing of a reset button **434** of FIG. **20** and, if so, the entire system is reset by turning over operational control to operation **466**. If there is no reset command, the Cybergym daemon continue to operate.

In FIG. **23**, the running of Cybergym Daemon A as part of process **468** is illustrated in greater detail. The process **468** begins at **472** and, in an operation **474**, the roster is fetched. As used herein, a "roster" is a list or the like of all exercise devices that are "known" to this server. That is, a server only communicates with a known list or "roster" of exercise devices, aka "client machines." Next, the server performs a roll call of the exercise devices on its roster in an operation **476**. If a exercise device which is on the roster does not respond despite repeated attempts, it is eventually removed from the roster. If the exercise device does respond, it is told to go to sleep, and is checked off on the roster that it met the roll call. Next, in an operation **478**, there is a broadcast greeting to new Cybergym™ machines, i.e., to new exercise devices which may have been brought within connection range to the server. If a new Cybergym machine is detected in an operation **480**, it is added to the roster and the broadcast greeting is again sent until the operation **480** does not attack any new exercise devices. At that point, the Cybergym sessions begin to execute with operation **484**.

FIG. **24** is a slow diagram illustrating the "Run Cybergym Sessions" process **484** of FIG. **23** in greater detail. Process **484** begins at **486** and, in an operation **488**, the roster is again fetched. A counter D is initialized to 1 and in operation **490** and then exercise device number D is called. If exercise device (D) responds as determined by an operation **494**, the

response is processed in an operation **496** and process controller is returned to operation **492**. If there is no response from the exercise device (D), it is determined whether all of the devices in the roster has been called in operation **498**. That is, the variable D is compared to the value NDEV and, if it is less than or equal to NDEV (the number of devices in the roster), the variable D is increased by 1 in an operation **500** and operation control is return to **492**. If the entire list has been called, operation control is returned to **488** to fetch the current roster.

FIG. **25** illustrates the "process response" operation **496** of FIG. **24** in greater detail. More particularly, process **496** begins at **502** and, in an operation **504**, the communication type is determined. If it is a key exchange communication type, an operation **506** performs a secure key exchange by one of a variety of methods, as was explained previously. The process is then completed at **508**. However, if the communication type as determined by operation **504** is transmit, an operation **510** determines whether there is data available for this device. This is typically determined by looking in a lookup table associated with a buffer. If there isn't any data available, then the process is completed at **508**. Otherwise, the data is encrypted and transmitted to the device in an operation **512**. Once the data has been transmitted to the device and, preferably, the device is indicated that the data has been received and decrypted properly, the buffer is cleared for that device in an operation **514** and the operation is completed at **508**. If the communication type is "receive", an operation **516** receives encrypted data from the exercise device. Next, the encrypted data is decrypted, preprocessed, and buffered as appropriate. The process is then completed at **508**.

FIG. **25A** illustrates an exemplary data packet sent in the transmit and receive operations that were discussed with reference to FIG. **25**. In this instance, to send and receive packets are in the same format, although this is not necessarily the case in all embodiments of this invention. In this one exemplary illustration, the data packet **520** has a set of start bits which are typically a recognizable pattern for a receiving device. Next, the user key is transmitted in portion **524** of the packet, the developer's key is provided in the portion **526** of the packet, the server ID is provided in the portion **528** of the packet, and the communication type is provided in portion **530** of the packet. In this example, following the communication type is a portion **532** which contains data. This data portion can be a fixed length or a variable length as will be appreciated by those skilled in the art. Finally, an end portion **534** of the data packet **520** signals the end of the packet.

In FIG. **26**, the "Run Cybergym Daemon B" process **468** is illustrated in greater detail. More particularly, process **468**B begins at **536**, and, in an operation **538**, there is an attempted connection to the Cybergym server. If, in operation **540**, it is determined that the connection to the server with the Internet was successful, process **468**B will run in online mode. The process **468**B will continue to run on the online mode **542** until the Cybergym server can no longer be accessed over the Internet, at which time process control will be turned over to operation **544** to run in an offline mode. This operation **544** is also evoked when the connection to the server is not successful as determined by operation **540**. The process **468**B will continue to run in the offline mode in operation **544** until an Internet connection to the server is again re-established, at which time operation control will be turned over to operation **542** to run in an online mode.

FIG. **27** is a flow diagram illustrating the "run online mode" process **542** of FIG. **26** in greater detail. The process **542** begins at **546** and, in an operation **548**, the system iterates over the exercise device buffers and collects data. That is, each of the exercise devices will have a buffer region for the storage of its data. Next, in an operation **550**, the data is encrypted. There are, of course, many suitable encryption techniques, although public key encryption is preferred in general. Public key encryption technologies are well known to those skilled in the art and are available both commercially and in the public domain (example, PGP encryption technology). Next, in an operation **552**, the data is transmitted to the Cybergym server via a socket connection. As is well known to those skilled in the art, a socket connection takes care of much of the housekeeping overhead in the transmission of data. For example, sockets typically take care of the buffering functions, etc., that implement and facilitate the transfer of data. Next, data is received from the Cybergym server via the socket. An operation **556** decrypts the data and distributes it to respective device buffers for later transmission to the devices via the process **596** as best seen in FIG. **25**. Finally, an operation **558** determines whether the Cybergym server is still online. If it is, process control is returned to operation **548**. If not, the process **542** is completed at **560**.

FIG. **28** is a flow diagram illustrating the process "Run Offline Mode" **544** of FIG. **26** in greater detail. Process **544** begins at **562** and, in an operation **564**, it is determined whether an connection to the Cybergym server has come online. If so, the process is completed at **566**, such that the process **468**B of FIG. **26** can run an online mode **542**. Otherwise, the process **544** continues to run in the offline mode and, in an operation **568**, the process iterates over the exercise devices and the buffer data. Next, in an operation **570**, it process the buffers in local mode. Finally, in an operation **572**, the process iterates over the exercise device and transmit data. Process control is then returned to operation **564**.

As will be apparent to those skilled in the art, as it is used herein "iterate" means that the system is going through the roster device by device or buffer by buffer in an iterative fashion. That is, from a starting point, it first processes the device or buffer associated with that starting point, and then the point is iterated (typically by 1) to process the next device or buffer in the roster or other list. When the end of the roster or list is reached, it may be started again from the beginning in a circular fashion.

FIG. **29** is an illustration of a mobile local system. More particularly, the mobile local system has a mobile exercise device controller **270**A and a mobile local server **272**A, which may be coupled together in an either wired or not wired fashion. Still alternatively, the devices **270**A and **272**A can be coupled together by the frame of the bicycle **274** or otherwise. It is quite common for bicycles to be provided with bicycle "computers" which provide such indication as speed, RPM, altitude, etc. The mobile exercise controller **270**A would take over this functionality as well as providing the functionality of the exercise device controller **280**. The mobile local server **272**A would have essentially the same functionality as the fixed server illustrated with reference to FIG. **21**, except that it preferably is a more "stripped-down" version, not including the options of the hard disk, graphics accelerator, and out-of-band transceiver. Also, lower power consumption devices would typically be used, and the connection to the Internet is by radio modem from an included antenna.

The mobile system illustrated in FIG. **9** can be in two-way communication via, for example, a cellular telephone system **576**. Alternatively, radio modem services such as formerly

provided by Ricochet, would be another communication methodology. While the server **272**A could conceivably service a number of control units **270**A, it is likely to be dedicated solely to that control unit. This is because bicyclists may not always be in sufficient proximity for the units **270**A to communicate with a single server **272**A and, in fact, bicycles that are in close proximity may not want to share the same server **272**A. Exceptions include such situations as group races or competitions, such as the Tour de France. In such an instance, a server **272**A could be in a pace car, which would service a number of controllers associated with individual bicycles.

The server **272**A is also preferably included with a variety of sensor inputs, including GPS from multiple satellites **578**, altimeter readings based on, for example, atmospheric pressure or, alternatively calculated from GPS information, inclinometers, etc. In this fashion, a mobile exercise device user can interact with a remote server, a trainer, or compete against other mobile and/or fixed exercise devices. For example, a user can be riding the bicycle while data such as distance, speed, RPM, elevation gain, etc., are transmitted to the remote server and provided to the trainer. The trainer can then download scripts or programs to the unit **270**A indicating that a user should pick up the pace, shift to a lower gear, etc. Furthermore, out-of-band communications can also occur with the trainer, for example, by cellular telephone connection. The mobile exercisers can also compete and interact with fixed exercisers, again with some scaling and/or handicapping.

FIG. **30** is an illustration of yet another form of mobile local system **256**B. More particularly, sensors and transmitters can be provided in the shoes **580** of a runner **582** which communicate with a mobile local server **272**B attached to the belt **584** of the runner **582**. For reasons similar to those discussed before, it is preferable that there be a one-to-one correspondence between the mobile units **270**B and the mobile local server **272**B. As was the case discussed with reference to FIG. **29**, the mobile local server **272**B can communicate with the Internet via a variety of channels, including radio modem channels, cellular phone channels, etc. The local mobile server **272**B also preferably has multiple sensoring modes, including GPS. Similar sensors can be provided for other sports and activities such as weight lifting, swimming, etc.

As indicated above, the mobile interactive local systems allow a user (athlete) to at least upload data via the Internet and, preferably, download information. While the "in-band" bandwidth may be somewhat limited in certain embodiments, it can be augmented without a band communications as well. In addition to allowing the recording of exercise parameters on the Cybergym server and interacting with a Cybergym trainer, the mobile exercise devices permit competitions, even against different classes of exercise devices. For example, with a suitable handicap, a runner can race against a cyclist who may be competing with someone on a stationary rowing machine. This also permits amateurs (presumably on fixed exercise devices) to compete with professionals on mobile exercise devices. Furthermore, "virtual worlds" can be created with which one or more users can interact. In one scenario, each user can be represented by a spaceship which can "fly" through space, have dogfights, etc. based upon the use of the exercise devices and optional in-band or out of band controllers.

FIG. **31** illustrates a possible screen that can be displayed on the personal computer system **262**A of a trainer **276**A. As described previously, in a preferred embodiment of the present invention, the computational functionality with respect to the trainer machine **264**A is provided by the Cybergym server **258**. Therefore, the trainer **276**A needs only to install a network browser on his trainer machine **262**A to enjoy full functionality of the system **250**. In this instance, the trainer **276**A point to his browser to a URL **588**, namely https://www.trainer.Cybergym.net. This brought up the display allowing the trainer to choose from a number of options. For example, the trainer can choose option: 1) coach online clients; 2) coach offline clients; 3) manage his or her coaching business; and, 4) communicate with Cybergym management. As is well known to those skilled in the art, the trainer **276**A can select one of these options with a pointer **590** controlled by a pointing device such as a mouse or trackball. The trainer **276**A then "clicks" on the pointer **590** by depressing the button on the mouse or trackball to select the appropriate next screen. It should be noted that these communications are all secured and encrypted, and are run over an https://connection.

FIG. **32** illustrates a screen **592** which can be accessed by selecting the "Coach Online Clients" option from the list on screen **586**. This is again a secure connection and it indicates all of the users in the group belonging to trainer **276**A that are currently online. If the user has a exercise device provided with a video camera, the image of the user is displayed on the screen as shown. If the user is not working with an exercise device equipped with a video camera, and "A" is provided in place of his or her image to indicate that they are riding anonymously, at least in the visual sense. Preferably, the trainer **276**A also has a trainer machine **262**A that is provided with a video camera which would allow his or her image to be displayed at the exercise device, as long as it was provided with sufficient out-of-band devices. Of course, as the capability of in-band transmission increases, this information may also be transmitted to the user via an in-band connection, as described above.

FIG. **33** illustrates a screen **594** which was accessed by selecting the user Jane Doe at **593**. This provides a full screen of information specifically about the user Jane Doe. The screen **594** can include a video portion **596**, basic information **598** about the user, information **600** concerning her exercise program, a variety of graphs and charts **602**, **604**, and **606** illustrating various parameters of her exercise history, and a comments field **610**. The screen **594** also preferably displays a display of the current script **612** running on the device while allowing the trainer to modify it and submit it back to the device by means of a on-screen button **614**. Similarly, the screen **594** also preferably includes a program window **616** which allows the trainer to view and modify the overall program for the user Jane Doe and to submit it by the on-screen button **618** to the user exercise device. An on-screen button **620** permits the trainer's camera to be toggled on and off and an on-screen button **622** permits a microphone to be switched on and off so that the trainer can either talk or not be heard by the user.

In FIG. **34**, a Cybergym™ server **260**A is described in greater detail. As will be appreciated by those skilled in the art, a server **260**A includes a hardware component and a software component. The hardware component (not show) is typically a personal computer, workstation, network server, etc. Sometimes it is implemented as a "virtual machine" wherein a number of logical machines are implemented on a single hardware machine. The software component **624** provides the functionality of the Cybergym system.

Software component **624** is based upon a database **626** which is used to store and retrieve information, programs (scripts), graphics, video, telemetry, and other data used in performance of the Cybergym system. This database is

preferably provided as a relational database, such as is provided by Oracle Corporation of Redwood Shores, Calif.

Communicating with the database **626** are daemons **628** and servlets **630**. The purpose of the daemons is to service the local servers, such as servers **254A**, **254N** and **256A**, at least partially through the Internet, or other Wide Area Network (WAN). The purpose of the servlets is to is to service the trainer machines, such as trainer machines **262A** and **262N**, as well as any personal computer or "workstation" **632** used by a user. As is well known to those skilled in the art, servlets are often used to provide web-based interfaces to database driven web sites.

FIG. **35** illustrates the daemon **628** of FIG. **34** in greater detail. Daemon **628** begins at **634** and, in an operation **636**, establishes a connection to the database **626**. Next, in an operation **640**, it determines whether there is a new connection with a local server. If so, an operation **642** opens a socket to communicate with a local server (such as local server **266A** or **272A**), and starts a new "thread." As is well known to those skilled in the art, a "thread" is a new process which operates asynchronously from its parent process (i.e. daemon **628**). Next, in an operation **644**, the socket connection made by operation **642** is processed. Process control then returns to operation **640**.

If operation **640** does not detect a new connection, then the daemon is put to "sleep" for a period of time k seconds, e.g. k=1–5 seconds. After the period of time has elapsed, an operation **650** determines if there is a system shutdown. If so, the operation of the daemon **628** ends at **652**. Otherwise, process control is again returned to operation **640**.

FIG. **36** illustrates the process "Process Socket Connection" **644** of FIG. **35** in greater detail. Process **644** begins at **654** and, in an operation **656**, the user ID(s) and system ID(s) are obtained from the socket that was created by operation **642**. Next, in an operation **658**, the data base is accessed to obtain any scripts or other data or programs that are to be sent to the local servers. Operation **660** determines if there are any scripts available and, if so, they are transmitted to the local server via the socket in an operation **662**. If there is telemetry or other data communication available from the socket as determined by an operation **664**, the telemetry and/or other data communication is read from the socket in an operation **666** and is written to the database in an operation **668**. An operation **670** then determines whether the connection has been lost, at which time the process is terminated at **672**. Otherwise, process control is returned to operation **658** to continue the processing.

FIG. **37** is a flow diagram illustrating the servlet process **630** in greater detail. The servlet **630** begins at **674** and, in an operation **676** it is determined if there is a "connection" from the web. By "connection" it is meant that a connection or "request" has been sent from an Internet enabled machine to the server **260A**. Upon the receipt of the request from, for example, a trainer at a trainer machine **262A** or a user at a personal computer **632**, the operation will recognize the desired connection and, in an operation **678**, will start a new thread, next, in an operation **680** the connection is processed, and the servlet will have completed its process at **682**. If a connection from the web is not recognized by operation **676**, an operation will determine if there has been a system shutdown. If so, the servlet is again completed at **682**. Otherwise, process control is returned to operation **676** to again look for a connection from the web.

FIG. **38** illustrates the process "Process Connection" **680** of FIG. **37** in greater detail. The process **580** begins at **686** and, in an operation **688**, parameters are received from the request that came with the connection. Next, the parameters are processed in an operation **690**. For example, if the trainer or user specified a request for information concerning a specific exercise session, it might be necessary to transform the name of the person received in the request into a user ID. Next, in an operation **692**, the data, program, graphic, video, etc. ("information") required to fulfill the request is read from the database **692**. Next, the information is processed in an operation **694**. An operation **696** determines whether the database should be updated, based on the request type. For example, some requests merely interrogate the database for information, while others require the storage of information in the database. If the database is to be updated, an operation **698** writes to the database and the process **680** ends at **700**. Otherwise, an operation **702** transmits the reply back to the requester, and the process again ends at **700**.

It will therefore be appreciated that in a preferred embodiment of the present invention, a distributed wide area network (WAN) such as the Internet is used to couple local servers, remote servers and workstations together. Users at local systems can interact visually and even in a tactile manner with other users over the Internet. For example, a first user at a first local station can take a "virtual ride" with another user at a second local station through the Internet connection. Likewise, a remote "personal trainer" can interact with a user at a local station via the Internet communication linkage. The present invention therefore allow group exercise experiences, even when a user is physically alone.

While this invention has been described in terms of several preferred embodiments, it is contemplated that alternatives, modifications, permutations and equivalents thereof will become apparent to those skilled in the art upon a reading of the specification and study of the drawings. It is therefore intended that the following appended claims be interpreted as including all such alternatives, modifications, permutations and equivalents as fall within the true spirit and scope of the present invention.

What is claimed is:

1. An exercise system comprising:

a local system including at least one exercise apparatus and at least one associated local server, said at least one local server monitoring the operation of said at least one exercise apparatus, said exercise apparatus and said local server having an in-band communication using a bid-directional wireless protocol;

an out-of-band communication with a user of said at least one exercise apparatus, wherein said out-of-band communication has a relationship to said in-band communication;

a remote server; and

wherein said local server and said remote server include communication interfaces which permits communication over a packet network connection that at least part-time couples said local server to said remote server for data communication between said local server and said remote server, such that said remote system may receive local system data from said local server concerning said operation of said exercise apparatus, and such that said local system may receive remote server data from said remote server providing feedback concerning said operation of said exercise apparatus.

2. An exercise system as recited in claim **1** wherein said local system is one of a plurality of local systems, each of which is in at least part-time communication with said remote server, and wherein said packet network operates on a TCP/IP protocol.

3. An exercise system as recited in claim **2** further comprising a workstation that is in at least part-time communication with said remote server.

4. An exercise system as recited in claim 3 wherein said workstation is a trainer machine.

5. An exercise system comprising:

at least one exercise apparatus having an in-band bi-directional wireless communication device;

an out-of-band communication device capable of a communication with a user of said at least one exercise apparatus that has a relationship to said in-band communication;

at least one associated local server having a bi-directional wireless communication device such that said exercise apparatus and said local server may communicate with each other via a wireless connection; and

at least one remote server in communication with said local server via, at least in part, an Internet connection, said remote server at least temporarily storing information concerning exercise sessions performed on said exercise apparatus.

6. An exercise system as recited in claim 5, further comprising scripts sent from said local server to said exercise apparatus via said wireless connection.

7. An exercise system as recited in claim 6 wherein said scripts were sent from said remote server to said local server.

8. An exercise system as recited in claim 5 wherein a protocol for said wireless connection is for the local server to interatively poll said exercise apparatus for communications from said exercise apparatus.

9. An exercise system as recited in claim 5 wherein a protocol for said wireless connection includes a roster of known exercise apparatus.

10. An exercise system as recited in claim 9 wherein wherein a protocol for wireless connection adds new exercise equipment which can newly communicate with said local server to said roster, and removes exercise equipment which is no longer in communication server from said roster.

11. A method for controlling an exercise device comprising:

running a program on a controller to affect the operation of an exercise device; and

wirelessly communicating with a local server to provide said local server with at least an exercise device ID which may be used to identify communications with said exercise device.

12. A method for controlling an exercise device as recited in claim 11 wherein the communication between said local server and said controller is encrypted.

13. A method for controlling an exercise device as recited in claim 11 wherein the communication between said local server and said controller is an in-band communication, and further comprising communicating with an out-of-band communication with a user of said exercise device.

14. A method for controlling an exercise device as recited in claim 11 wherein said communication is by radio-frequency packets.

15. A method for controlling an exercise device as recited in claim 11 further comprising:

communicating between said local server and a remote server via, at least in part, the Internet.

16. A method for controlling an exercise device as recited in claim 15 wherein said remote server is database driven.

17. A method for controlling an exercise device as recited in claim 16 wherein said database is a relational database.

18. A method for controlling an exercise device as recited in claim 17 wherein said remote server communicates with said local server via a daemon.

19. A method for controlling an exercise device as recited in claim 15 further comprising at least one machine coupled to the Internet for communicating with said remote server via an Internet browser.

20. A method for controlling an exercise device as recited in claim 19 wherein said machine is one of a trainer machine and a user machine, and wherein said remote server communicates with said machine with a servlet running on said remote server.

* * * * *

CERTIFICATE OF SERVICE

I, R. Parrish Freeman, counsel for appellant Icon Health & Fitness, Inc., hereby certify that on this 2nd day of October, 2015, the foregoing **BRIEF OF APPELLANT ICON HEALTH & FITNESS, INC.** was filed electronically with the U.S. Court of Appeals for the Federal Circuit by means of the Court's CM/ECF system. I further certify that the foregoing was served on the following counsel of record, by means of electronic mail:

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CERTIFICATE OF COMPLIANCE

1. This brief complies with the type-volume limitation of Federal Rule of Appellate Procedure 32(a)(7)(B) because the brief contains 11,849 words, excluding those parts of the brief that are exempted by Federal Rule of Appellate Procedure 32(a)(7)(B)(iii).

2. This brief complies with the typeface requirements of Federal Rule of Appellate Procedure 32(a)(5) and the type style requirements of Federal Rule of Appellate Procedure 32(a)(6) because this brief has been prepared in proportionally spaced typeface using Microsoft Word in 14-point Book Antiqua font.

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